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ANTECEDENTS AND OUTCOMES OF ABSORPTIVE CAPACITY: THREE STUDIES IN THE SPANISH MANUFACTURING SECTOR

TESIS DOCTORAL

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A mi familia

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ÍNDICE:

LISTA DE TABLAS

LISTA DE FIGURAS

Capítulo 1:

Introducción

1.0 INTRODUCCIÓN AL TEMA DE INVESTIGACIÓN DE LA TESIS

En los últimos años, las investigaciones en dirección estratégica han señalado al conocimiento como uno de los recursos claves que permiten la creación y mantenimiento de ventajas competitivas. De manera particular, la habilidad para generar innovaciones se ha recibido una gran atención de los académicos, ya que se ha demostrado que las empresas innovadores son capaces de generar una mayor ventaja competitiva (Geroski et al. 1993; Hall 2000; Czarnitzki y Kraft 2004; Volberda et al., 2010). Aunque la importancia del conocimiento como recurso estratégico clave y fuente de ventaja competitiva ha sido contemplada dentro del marco de enfoques tradicionales como el de recurso y capacidades, el nivel de dinamismo de los actuales entornos empresariales ha llevado a los académicos a dejar de considerar los recursos y capacidades como estáticos.

En entornos dinámicos, el conocimiento como recurso estático no permite la generación de ventajas competitivas, más bien esta generación va a venir como fruto del establecimiento de procesos que permitan un flujo y un uso eficiente de dicho conocimiento (Danneels, 2008; Bingham y Davis, 2012). En ese sentido, sólo aquellas organizaciones que sean capaces de llevar a cabo los cambios necesarios para adaptarse continuamente a los nuevos requisitos de la demanda el entorno, lograrán mantener su rentabilidad en el largo plazo (Helfat y Winter, 2011).

Esta situación de continuo cambio ha demandado la elaboración de un marco teórico adecuado, capaz de ofrecer una explicación de cómo ciertas empresas logran mantener su ventaja competitiva aun cuando éstas llevan a cabo su actividad en entornos de carácter dinámico. Los esfuerzos en esta línea han llevado a extender el enfoque tradicional basado en los recursos hacia lo que se ha denominado como perspectiva de capacidades dinámicas (Teece et al., 1997; Eisenhardt y Martin, 2000; Easterby-Smith y Prieto, 2008; Ambrosini y Bowman, 2009; Barney et al., 2011). Según esta perspectiva, las organizaciones deben reconfigurar continuamente su base de recursos y capacidades, de manera que éstas se mantengan adaptadas a las nuevas demandas que exige el entorno (Teece et al., 1997). Aunque en la literatura sobre capacidades dinámicas no existe un consenso sobre los elementos que intervienen en la reconfiguración de las capacidades y recursos esenciales, varios académicos coinciden en que el aprendizaje organizativo es uno de ellos.

Los procesos de aprendizaje permiten a las empresas cambiar o modificar sus modelos mentales, reglas, procedimientos o conocimiento logrando mejorar su desempeño (Cyert y March, 1963; Hedberg, 1981; Argyris y Schön, 1978; Senge, 1990; Brown y Duguid, 1991; Dibella et al., 1996). Según señala Dodgson (1993) estas modificaciones permiten mantener y mejorar la competitividad de las organizaciones, incluso en condiciones marcadas por incertumbre tecnológicas o de mercado. Una de las vías comúnmente utilizadas por las organizaciones para renovar la base de conocimiento existente consiste en sostener relaciones con distintos tipos de agentes externos (Murovec y Prodan, 2009). Sin embargo, en ocasiones el conocimiento que las organizaciones precisan para determinados procesos no se encuentra disponible en las fuentes externas lo cual, las obliga a crear dicho conocimiento internamente a través de actividades de I+D (Argote, 2011). No obstante, sin importar la vía que las organizaciones tomen para acceder o crear conocimiento nuevo, es de suma importancia

que estas creen las condiciones que faciliten el desarrollo de los procesos de aprendizaje que permitan la correcta absorción de dicho conocimiento (Lane et al., 2006; Lichtenthaler, 2009; Volberda et al., 2010).

1.1 JUSTIFICACIÓN Y OBJETIVOS DE LA INVESTIGACIÓN

La capacidad de absorción *"Absorptive Capacity" (CA)* constituye uno de los constructos más importantes que ha emergido en las investigaciones de la teoría de las organizaciones en las últimas décadas (Lane et al., 2006). Muestra de ello es el gran número de publicaciones que han utilizado el concepto y además, la diversidad de campos en los cuales ha sido aplicado (Zahra y George, 2002; Lane *et al.*, 2006; Todorova y Durisin, 2007; Volberda *et al.*, 2010). A pesar de las constantes contribuciones realizadas al concepto, estudios recientes muestran que el concepto todavía se encuentra rodeado de cierta incertidumbre que impide explotar su potencial (Volberda et al., 2010). Por ejemplo, Lane et al., (2006) tras la revisión de 289 artículos escritos sobre el concepto señalan que éste ha sido utilizado hasta el momento de una manera reducida, ya que la mayor parte de los artículos habían tratado la temática como una mera citación sin discutir ni profundizar sobre los aspectos centrales del concepto.

En otra importante aportación, Volberda et al. (2010) resalta que el concepto presenta cierto grado de ambigüedad respecto a su (1) definición y naturaleza, (2) los dominios en los que existe, (3) sus implicaciones y principales antecedentes (Zahra y George, 2002, Lane et al., 2006, Todorova y Durisin, 2007, Easterby-Smith et al., 2008, Camisón y Forés, 2010, Sun y Anderson, 2010, Volberda et al., 2010). Asimismo, otros estudios reclaman la necesidad de profundizar sobre el carácter multidimensional del concepto y cómo diferentes factores inciden en el desarrollo de las distintas dimensiones que lo conforman (Lichtenthaler, 2009; Jansen et al., 2005; Volberda et al., 2010; Sun y Anderson, 2010). Basado en lo anterior, nuestro principal objetivo es proporcionar una

mejor explicación acerca de los factores que inciden en el desarrollo de la capacidad de absorción en las organizaciones y contribuir al entendimiento de cómo dicha relación ayuda a explicar la existencia de diferencias en el desempeño de las organizaciones.

En los últimos años, la forma de concebir la capacidad de absorción ha evolucionado pasando de ser considerada como un concepto unidimensional a ser contemplada como un tipo de capacidad dinámica que permite a las organizaciones adaptarse a los continuos cambios del entorno, a través del desarrollo de tres procesos de aprendizaje: exploración, transformación y explotación (Lane e tal., 2006; Lichtenthaler, 2009). Una de las actuales limitaciones en la investigación sobre esta nueva concepción de la AC es la falta de estudios que analicen cómo factores internos a las organizaciones inciden sobre las dimensiones que lo conforman (Volberda et al., 2010: 948). Por ello, en el primero de los artículos hemos visto pertinente evaluar bajo esta nueva concepción qué factores reconocidos en la literatura sobre aprendizaje organizativo, facilitan el desarrollo de esta capacidad. Son varios los autores que subrayan el papel central que juega el aprendizaje organizativo en el desarrollo de capacidades dinámicas (Madhok y Osegowitsh, 2000; Eisenhardt y Martin, 2000; Sirmon et al., 2007; Easterby-Smith y Prieto, 2008). Por lo tanto, nuestra intención es evaluar qué acciones promovidas a nivel interno en las organizaciones contribuyen al desarrollo de los distintos procesos de aprendizaje de la capacidad de absorción. Además, deseamos comprobar en qué sentido ocurre dicha relación.

La segunda de las limitaciones resaltadas en la literatura es la necesidad de conocer cómo las redes interorganizativas inciden sobre esta capacidad (Volberda et al., 2010: 946). Estudios previos señalan que las redes sociales y la profundidad de los vínculos pueden afectar la capacidad de absorción de las empresas (Murocec y Prodan, 2009; Rothaermel y Alexandre, 2009). Sin embargo, la mayor parte de estos estudios se han centrado en

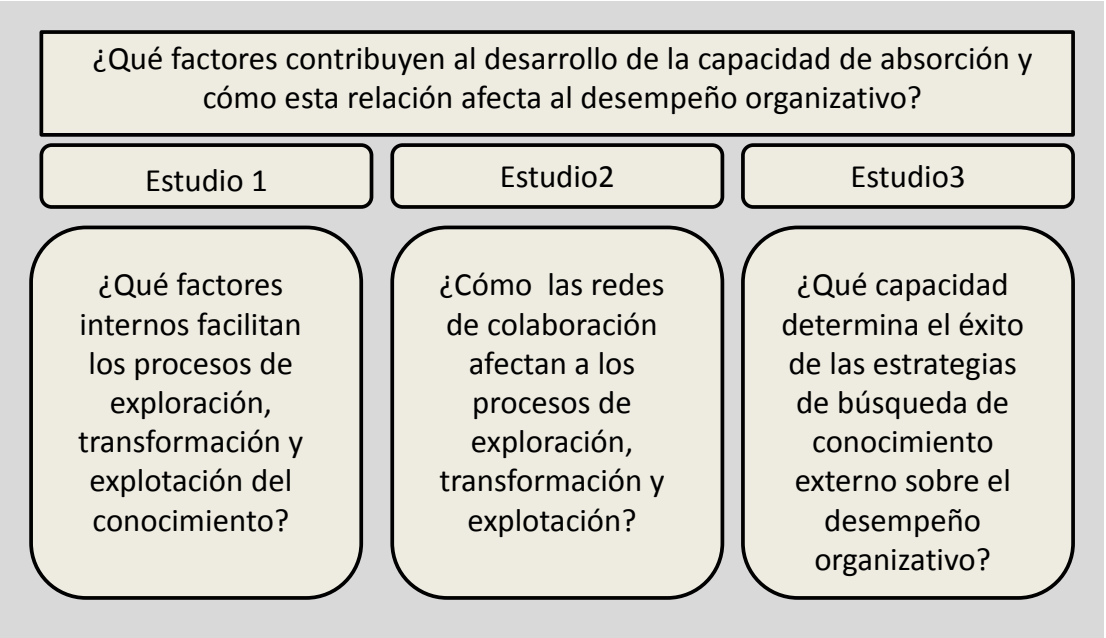
examinar las redes individuales (Cockburn y Herderson, 1998; Fabrizio, 2009; Vinding, 2006; Lee et al., 2010) o el efecto que tienen este tipo de colaboraciones sobre la capacidad de absorción en términos generales (Por ejemplo: Murovec y Prodan, 2009), y no sobre los distintos procesos de aprendizaje que intervienen en el procesamiento de la información adquirida. Dado que los retos de gestión que se presentan en cada uno de los procesos de aprendizaje difieren, distintos aspectos del conocimiento externo podrían ser críticos en el desarrollo de CA a nivel organizativo. Por ello, en nuestro segundo artículo buscamos abordar más a fondo las relaciones antes mencionadas y evaluar si el efecto que tienen las distintas estrategias de búsqueda de conocimiento difieren dependiendo del tipo de proceso de aprendizaje que la empresa trata de desarrollar. Dicho análisis podría ayudarnos a proporcionar un mayor entendimiento del efecto de las redes externas sobre el desarrollo de la capacidad absorción y además, comprender por qué algunas organizaciones presentan deficiencias en su desarrollo.

Por último, encontramos estudios que relacionan los vínculos externos con la mejora de la innovación y el desempeño de las organizaciones (Belderbos et al., 2004; Faems et al., 2005; Inauen y Schenker-Wicki, 2011). Según declaran investigaciones realizadas en esta línea, las organizaciones raramente innovan por sí solas, por lo cual, para incrementar el acceso a ideas nuevas, tratan de colaborar con distintos tipos de actores externos como pueden ser clientes, proveedores, universidades, agencias tecnológicas e incluso competidores (Chesbrough, 2003; Laursen y Salter, 2006; Chen et al., 2011). Aunque la innovación abierta apunta a ser un campo de investigación de gran interés, sólo existen algunos estudios empíricos recientes que analizan este campo en detalle (Chen et al., 2011). Uno de los principales problemas que hemos podido identificar en este campo son los resultados encontrados acerca del efecto que tienen este tipo de estrategias sobre el desempeño de las organizaciones (Por ejemplo: Faems et al., 2005; Laursen y Salter, 2006; Chen et al., 2011). Una posible

explicación de las diferencias entre los hallazgos encontrados es que la relación entre la apertura de los procesos de innovación y el desempeño alcanzado sea más compleja que lo previamente asumido. Salvo algunas excepciones, la mayor parte de los estudios empíricos en este campo han asumido una relación directa entre la estrategia de búsqueda de conocimiento externo y el desempeño alcanzando, dejando de lado otras variables organizativas que puedan intervenir en dicha relación. Según declaran estudios previos, la simple posesión de conocimiento no contribuye al desarrollo de ventaja competitivas en la organizaciones, sino que esta última va a depender de la posesión o desarrollo de los procesos que permitan la aplicación eficiente de los mismos (Daghfous, 2004; Yu-Shan et al., 2009; Lichtenthaler, 2009; Bingham y Davis, 2012). En nuestro tercer artículo, tratamos de dar respuesta a las diferencias en los resultados encontrados acerca del efecto de la estrategia de búsqueda de conocimiento sobre el desempeño al proponer que el efecto de dichas estrategias se produce indirectamente mediante la capacidad de absorción.

Para poder cumplir con eficacia cada uno de los gaps que presentamos, nos parece relevante realizar una revisión teórica desde la perspectiva de recursos a la perspectiva de capacidades dinámicas, pasando por la literatura de aprendizaje. Estas tres líneas han contribuido al desarrollo del concepto de capacidad de absorción. Asimismo, hemos visto pertinente realizar una revisión de las principales definiciones, antecedentes y consecuentes abordados sobre el concepto. Con esta revisión pretendemos estar más preparados para abordar las cuestiones que nos planteamos. En la figura 1.1 se muestran cada uno de los objetivos de investigación.

Figura 1.1 Objetivos de la tesis



1.2 METODOLOGÍA

1.2.1 Sectores analizados

La parte empírica de la tesis doctoral recoge cuatro sectores industriales españoles: cerámico, biotecnología, calzado y juguete. A continuación proporcionamos una breve descripción de cada sector.

1.2.1.1 Sector Cerámico

En lo últimos años el sector cerámico español se ha enfrentado a las presiones crecientes de la globalización de los mercados, en particular a las presiones de productores de menor coste como China y Brasil (Alegre y Chiva, 2008). A pesar de esta amenaza, según datos publicados por el Instituto Valenciano de Exportaciones (IVEX), España es el segundo mayor productor de azulejos a nivel Europeo y el tercer mayor exportador de azulejos. A nivel de exportaciones únicamente la superan China e Italia que ocupan el primer y segundo lugar respectivamente. Esta presencia global de la industria de azulejo español se debe en gran parte a las innovaciones en diseño y a las tecnologías empleadas para su desarrollo (McDonald y Vertova, 2001; Chiva, 2004). La mayor parte de las

organizaciones en este sector suelen ser pequeñas y medianas empresas con no más de 250 empleados y además, tienden a estar concentradas en sectores industriales (IVEX, 2012; Enright and Tenti, 1990).

Asimismo, cabe destacar que las colaboraciones con agentes externos (como son universidades, proveedores e incluso competidores) son frecuentes. Un ejemplo de esto lo observamos en Castellón donde existe una fuerte unión entre el sector y la universidad Jaume I en la que se encuentra ubicado el Instituto Tecnológico de la Cerámica (ITC). Dicho instituto, aparte de servir como oficina de transferencia de las investigaciones realizadas en el ámbito de la cerámica, ofrece formación especializada para el sector. Además, existe mucha colaboración de las empresas cerámicas españolas con empresas ubicadas en otros distritos industriales como es el caso de la colaboración de las empresas agrupadas en el distrito industrial de Castellón con aquellas ubicadas en el distrito industrial de Emilia-Romagna en Italia (Hervas-Oliver et al., 2011).

1.2.1.2 Sector del Calzado

De acuerdo con datos publicados por el Instituto Nacional de Estadística (INE) la mayor parte de las empresas presentes en el sector calzado tienen como media menos de 250 empleados. El principal motor de este sector lo constituyen las exportaciones, las cuales durante el año 2011 presentaron un comportamiento positivo con unos crecimientos significativos, tanto en pares de zapatos exportados como en el valor de las exportaciones (12,4% y 8,6% respectivamente). La mayor parte de las empresas del sector se encuentran ubicadas en la Comunidad Valenciana, encontrándose cerca del 66% de las empresas españolas del calzado en la provincia de Alicante (Elche, Elda, y Villena), Castellón (concretamente en Vall de Uxo) y en otras localidades de la Comunidad (FICE, 2011).

El sector del calzado no es un sector en el que se produzcan grandes cambios tecnológicos. Más bien, las principales innovaciones introducidas

en el sector se deben principalmente al monitoreo y seguimiento de las tendencias, así como al aprovechamiento de los desarrollos y avances generados por agentes externos como son los proveedores, las universidades, institutos de investigación o industrias relacionadas (Molina-Morales, 2008; Tomas el et al., 2000). Por ejemplo, las innovaciones introducidas por los proveedores de maquinaria o de las materias primas permiten a estas empresas incrementar su productividad o la mejora de los diseños de los productos que ofrece (Martínez et al., 2012). Del mismo modo, la colaboración con institutos de investigación, como es el caso del Instituto del Calzado (INESCOP, 2012), les permite el acceso a servicios especializados como son el monitoreo tecnológico, con el cual ponen a disposición de estas organizaciones los avances obtenidos a través del desarrollo de proyectos internacionales y multisectoriales, así como el asesoramiento sobre necesidades específicas que puedan tener estas organizaciones (Tomás et al., 2000)

1.2.1.3 Sector de Biotecnología

Este sector es bastante amplio y comprende campos diversos como son el área farmacéutica, el área de productos químicos orgánicos, agricultura, ciencias veterinarias, medicina e incluso la disposición de desperdicios (Powell et al., 1996). En la industria de Biotecnología, España representa el cuarto país en producción científica. Únicamente es superada por Reino Unido, Alemania y Francia y además crece a un ritmo cuatro veces mayor que la media europea. Aunque el tamaño del sector de Biotecnología parezca ser pequeño comparado con el resto de mercados, éste crece a un ritmo del 15% anual, lo que supera tres veces el experimentado por Alemania y cinco veces el de Estados unidos (IVEX, 2012). En lo que corresponde a la distribución del sector, la mayor parte de las empresas presentan una plantilla que no supera los 250 empleados. La Comunidad Valenciana representa la cuarta región de España con mayor densidad de

empresas del sector, a ésta le anteceden Madrid, Cataluña y Andalucía (IVEX, 2012).

Este sector constituye una industria de alta intensidad tecnológica, por lo cual la inversión que hace en I+D es mayor que la de muchos sectores. Por ejemplo este índice experimentó un incremento del 11.2% en los últimos años (ASEBIO, 2012). Las empresas de este sector tienden con frecuencia a establecer empresas conjuntas, acuerdos de colaboración, licencias y otras clases de redes de colaboración con el fin de facilitar el acceso y la creación de los recursos y capacidades que necesita (Arora y Gambardella, 1990, 1994; Powell et al., 1996).

1.2.1.4 Sector del juguete

El sector del juguete español se caracteriza por la producción de artículos de alto nivel de calidad, diseño y con valores educativos lo cual le ha permitido a las del sector competir frente a los producidos por competidores como China (Holmstrom, 2005; AEFJ, 2012). Este sector se encuentra bastante atomizado, ya que está formado en su mayoría por pequeñas y medianas empresas las cuales generan alrededor del 80% de los cinco mil puestos de trabajo de esta industria (ICEX, 2012). El mayor número de las empresas de este sector se encuentran albergadas en la Comunidad Valenciana, la cual concentra el 38,40% de las empresas. A esta región le siguen en tamaño Cataluña (31,10%), Madrid (12,3%) y Murcia (5%).

Los ingresos en ventas de este sector provienen de las exportaciones. Según datos publicados por el servicio de Estadística de Comercio Exterior (ESTACOM), las exportaciones entre enero y agosto de 2011 alcanzaron una cifra de 173,5 millones de euros, lo que representa un 44% más que el año pasado (ICEX, 2012). Entre los primeros países de destino de los juguetes españoles destacan Francia, Portugal y Alemania las cuales en conjunto concentran cerca del 53% del valor exportado por el sector (IVEX,

2012). Otro de los países de destino que cabe destacar es Rusia, el cual incrementó sus importaciones en un 95% durante el año 2011. Los principales productos de exportación lo constituyen los juguetes tradicionales, siendo España el país pionero en esta actividad. El incremento de las importaciones de juguetes de China (por ejemplo, el 74% de la importaciones realizadas en la Comunidad Valenciana provinieron de China), representa una de las principales amenazas que tiene el sector.

1.2.2 Técnicas estadísticas empleadas

En la parte empírica de esta tesis empleamos el análisis multivariante. Los análisis multivariante se refieren a los métodos estadísticos en los que se analizan de manera simultánea medidas múltiples de un objeto o individuo sometida a estudios (Hair et al., 2006). Dado que en los artículos de la presente tesis se analizan simultáneamente más de dos variables el método correspondiente es el análisis multivariante. Entre las técnicas más populares utilizadas en la investigación en dirección de empresas se encuentran los análisis de regresión múltiple (por ejemplo: Jansen et al., 2005; Laursen y Salter, 2006, Murovec y Prodan, 2009; Chen et al., 2011), así como los modelos de ecuaciones estructurales (Por ejemplo: Alegre y Chiva, 2008; Henseler et al., 2009). En nuestro caso, empleamos el análisis de regresión múltiple en los capítulos 3 y 4, y los modelos de ecuaciones estructurales para el capítulo 5. A continuación presentamos una descripción de ambas técnicas.

1.2.2.1 Regresión lineal múltiple

El análisis de regresión lineal múltiple representa una de las técnicas estadísticas más utilizada en las ciencias sociales. Esta técnica permite analizar la relación entre una única variable dependiente (criterio) y varias variables independientes (predictores). El objetivo que se persigue con esta técnica es utilizar las variables independientes cuyos valores son

conocidos para predecir la única variable criterio seleccionada por el investigador (Hair et al., 1998: 144). En la regresión múltiple, cada variable predictora es ponderada, de forma que la ponderación indica el peso relativo de cada variable independiente a la predicción conjunta. Al llevar a cabo el cálculo de la ponderación, el procedimiento de análisis asegurará la máxima predicción a partir del conjunto de variables independientes. Asimismo, el cálculo permite examinar la influencia de cada variable independiente en la relación. No obstante, en este último aspecto es necesario tener especial cuidado, ya que en ocasiones la correlación entre las variables puede complicar el proceso de interpretación (Hair et al., 1998). Según establece Hair et al. (1998) para llevar a cabo los análisis de regresión lineal múltiple, es necesario que se cumplan las siguientes dos condiciones: (a) los datos deben ser métricos o haber sido previamente transformados, y (b) se debe decidir qué variable va a actuar como dependiente y cuáles como productoras.

1.2.2.2 Modelos de ecuaciones estructurales

Los modelos de ecuaciones estructurales constituyen un técnica multivariante que permiten la estimación simultánea de ecuaciones múltiples. Esta técnica permite examinar el modo en que diferentes constructos se relacionan con variables observables, así como la forma en que los constructos o variables latentes se relacionan entre sí (Batista y Coenders, 2000). De esta forma, la aplicación de modelos de ecuaciones estructurales para evaluar relaciones teóricas, es equivalente a realizar un análisis factorial y de regresión en un solo paso. Dada estas ventajas, el uso de modelos de ecuaciones estructurales ha ganado gran popularidad en las ciencias sociales (Batista y Coenders, 2000). Los modelos de ecuaciones estructurales se distinguen principalmente por tres características esenciales: (1) permiten la estimación de relaciones de dependencia múltiples y cruzadas, (2) proporcionan la capacidad de representar conceptos no observados en estas relaciones y tener en cuenta

el error de medida, y (3) permiten definir un modelo para explicar el conjunto completo de relaciones (Hair et al., 2006).

La primera de estas características hace referencia a que en un paso previo el investigador, tras realizar un análisis de la literatura, define distintas variables independientes que predicen a las variables dependientes seleccionadas. Sin embargo, en relaciones ulteriores, las variables dependientes se podrían convertir en independientes, dando lugar a la naturaleza interdependiente del modelo estructural. Además, es posible que una misma variable afecte a cada una de las variables dependientes, pero con distinto efecto. Los modelos estructurales permiten llevar a cabo simultáneamente los análisis antes mencionados incluso cuando una variable dependiente se convierte en variable independiente en otras relaciones.

La segunda característica corresponde a la flexibilidad de los modelos de ecuaciones estructurales para incluir variables latentes en el análisis. Una variable latente es un concepto teórico supuesto y no observado que sólo puede ser aproximado mediante variables observables o manifiestas y que además, presenta un cierto grado de error en su medición. Frente a otras técnicas multivalentes, los modelos de ecuaciones permiten incluir los errores de medida presentes en las variables exógenas y endógenas. Del mismo modo, permiten llevar a cabo la estimación de la fiabilidad y la validez de las escalas de medida.

La última de las ventajas de los modelos de ecuaciones estructurales es que permiten la construcción de un modelo en el que se recoge el conjunto sistemático de relaciones con las cuales se trata de ofrecer una explicación exhaustiva y consistente de un fenómeno dado (Hair et al., 2006).

1.3 ESTRUCTURA DE LA TESIS DOCTORAL

Para la presente tesis hemos escogido el enfoque de "tesis como producto", cuyo objetivo es desarrollar habilidades investigadoras a través

del proceso de producción científica en formato de artículos publicables (Krathwohl, 1988). Por ello la tesis se desarrolla mediante tres capítulos empíricos sustentados por un capítulo teórico. Cada uno de los artículos cuenta con su propia introducción, marco teórico, hipótesis, resultados y discusión, por lo cual representan artículos independientes Aunque los tres capítulos empíricos son independientes, estos constituyen parte de un estudio integrado con el cual se busca recoger los resultados de las relaciones propuestas de manera aislada y proporcionar una visión completa de los nexos posibles entre las estrategias consideradas. Por lo antes expuesto, adaptamos las variables y las técnicas estadísticas a los objetivos perseguidos en cada trabajo.

En el capítulo 2 presentamos una visión general de las principales perspectivas teóricas que dieron origen a la capacidad de absorción, así como una revisión de las definiciones del concepto, los antecedentes y consecuentes del concepto. El objetivo que perseguimos en este capítulo teórico es proporcionar sustento al enfoque en que se basan los tres estudios empíricos de la tesis y además, proporcionar una visión global del concepto analizado. Por lo cual, no pretendemos hacer una revisión exhaustiva de todos los conceptos que se abordan en la tesis para justificar las preguntas de investigación como se suele hacer en las tesis convencionales.

En el capítulo 3 presentamos el primero de nuestros trabajos empíricos en el que se analiza el efecto de distintos factores facilitadores del aprendizaje sobre los procesos de exploración, transformación y explotación del conocimiento. Seguido de este, en el capítulo 4 presentamos el segundo de los artículos en el cual analizamos el efecto que tienen las estrategias de búsqueda de conocimiento externo sobre los procesos de exploración, transformación y explotación del conocimiento. En el capítulo 5 analizamos el papel mediador de la capacidad de absorción en la relación existente entre las estrategias de búsqueda de conocimiento externo y el

desempeño alcanzado por las organizaciones. Finalmente en el capítulo 6 presentamos las principales conclusiones obtenidas en el estudio.

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Capítulo 2:

Marco teórico general

2.0 OBJETIVOS Y CONTENIDO DEL CAPÍTULO

El presente capítulo sirve como marco teórico general para los tres artículos presentados. En este llevamos a cabo una reflexión sobre algunas de las perspectivas que dieron origen al concepto de capacidad de absorción iniciando desde el enfoque de recursos y capacidades, pasando por las capacidades dinámicas y finalizando en el aprendizaje organizativo. Asimismo, desglosamos parte de las principales aportaciones llevadas a cabo tanto a la definición como los antecedentes del concepto. Con este capítulo no pretendemos presentar la suma de los marcos teóricos de los tres artículos, sino la evolución del enfoque teórico en el que se apoyan.

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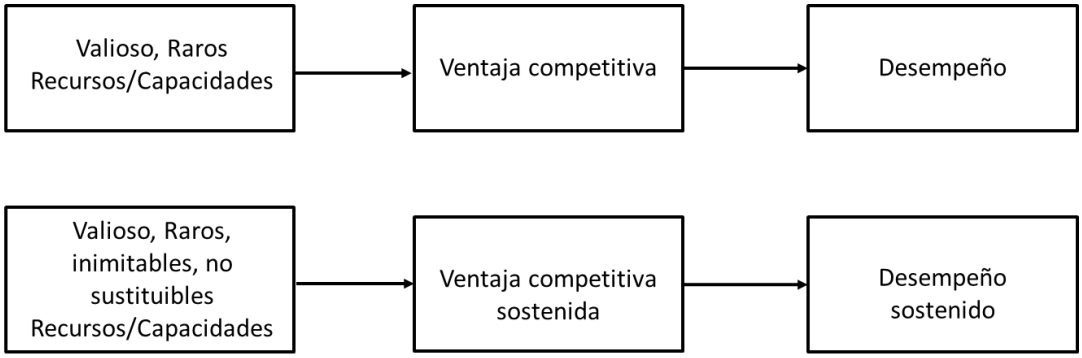
2.1 PERSPECTIVA BASADA EN LOS RECURSOS Y CAPACIDADES

La perspectiva de la empresa basada en los recursos (*Resourced Based View*) o también conocida como la perspectiva de los recursos y capacidades surgió en 1959 con el libro titulado "*The Theory of the Growth of the Firm*", cuyo autor es Penrose. Al igual que Penrose, Rubin (1973) es considerado como uno de los pocos autores en conceptualizar la empresa como un conjunto de recursos. Este autor considera que los recursos por si solos no son útiles, por lo cual las organizaciones deben previamente procesarlos para poder producir un valor (Rubin 1973: 937). No obstante, no es hasta 1984 que Wernerfelt establece las primeras bases formales de esta teoría. Tomando como base los trabajos de Penrose y Rubin, Wernerfelt argumenta que las organizaciones podrían generar mayores beneficios a través de la identificación y la adquisición de recursos críticos para el desarrollo de los productos que son demandados. Esta línea de pensamiento fue luego abordado por otros autores, los cuales proporcionaron un mayor entendimiento de la concepción abstracta que Wernerfelt´s hacía de los recursos y capacidades. Dos de los trabajos punteros que dieron una visión más clara de esta nueva perspectiva fueron los trabajos de Prahalad y Hamel´s (1990) y el de Barney (1990).

En un primer lugar, Prahalad y Hammel´s (1990) consideran que la habilidad de las organizaciones para crear productos nuevos radicales depende principalmente de la forma en que estas gestionan sus competencias centrales. Este argumento sigue la misma línea previamente establecida por Penrose (1959) y Rubin (1973) y destaca que no sólo la posesión de recursos es necesaria, sino que también estos deben ser desplegados de una manera inimitable. A pesar de la importante aportación del trabajo de Prahalad and Hamel´s (1990), este trabajo tenía una orientación más práctica lo cual limitaba probar empíricamente varias de sus proposiciones sobre la explotación de los recursos (Wernerfelf, 1995).

La segunda de las aportaciones hechas a la perspectiva de recursos y capacidades es la realizada por Barney´s (1991). Dicho trabajo es considerado por muchos como la primera formalización hecha a esta perspectiva (Newbert, 2007). Barney (1991) toma como base las aportaciones hechas por autores como Penrose (1959), Rumelt (1984), Wernerfelt (1984), establece dos asunciones principales sobre los recursos y capacidades. Por un lado, considera que los recursos y capacidades se encuentran distribuidos de manera heterogénea en las organizaciones. Por otro lado, señala que estos son de movilidad imperfecta. Estas dos asunciones en conjunto son las que hacen que la dotación de recursos persista a través del tiempo y que además, se generen ventajas competitivas. Según Barney (1991), la posesión de recursos valiosos y raros, permitirán a las empresas generar ventajas competitivas en el corto plazo. Sin embargo, para que las organizaciones puedan ser capaces de generar una ventaja competitiva a lo largo del tiempo, dichos recursos deben ser a su vez inimitables y no sustituibles.

Figure 2.1 Modelo conceptual de Barney (1991)



Fuente: adaptado de Newbert et al., 2007

Tras el trabajo de Barney (1991), varios académicos que han abordado el tema han criticado algunos de los planteamientos realizados por este autor. En un estudio reciente, Kraaijenbrink et al. (2010: 352) recoge las principales críticas realizadas a la RBV y las divide en ocho tipos. A continuación llevamos a cabo un resumen de estas críticas:

- *No presenta implicaciones prácticas para los directivos:* de acuerdo con Priem y Butler (2001), la RBV no contempla los procesos que siguen las organizaciones para poder convertir determinados recursos en ventajas competitivas, por lo cual no deja claro cuáles son los caminos que los directivos deben seguir. Asimismo, esta perspectiva evoca una visión de control total por parte de los directivos, dejando de lados aspectos como son los problemas de derecho de propiedad y los límites que tiene los directivos para predecir el valor futuro de los recursos (McGuinnes and Morgan, 2000). Como respuesta a estas críticas, Barney (2005) señala que la RBV no pretende establecer recetas para los directivos, más bien lo que trata de explicar las causas de las diferencias en el desarrollo de ventajas entre las organizaciones.

- *La RBV implica regresiones infinitas:* Unos de los planteamientos generales de la RBV es que los directivos deben perseguir el desarrollo de capacidades de segundo orden, ya que ello asegura la obtención de renta superiores al resto de la competencia. Basado en lo anterior, "si una organización presenta la capacidad superior de desarrollar estructuras que permitan innovar en los productos, estas superaran a las empresas que actualmente disponen de una capacidad básica de innovar" (Collis, 1994:148). Según Collis, esta búsqueda de capacidades de mayor nivel puede extenderse al infinito, llevando a las organizaciones a una búsqueda sin fin de estas capacidades. Por lo cual, un planteamiento de capacidades mayores, por ejemplo de tercer o cuarto orden, podría llevar a asunciones difíciles de contrastar y que además, carezcan de implicaciones prácticas reales (Collis, 1994; Priem and Butler, 2001; Lado et al., 2006).

- *La aplicabilidad de la RBV es muy limitada:* De acuerdo con Barney (2002) uno de los límites importantes de la RBV es que las asunciones que hace sobre la sostenibilidad de las ventajas competitivas son sólo aplicable cuando las condiciones del entono se mantienen fijas (Miller, 2003; Gibbert, 2006a, 2006b). Por lo cual, en entornos turbulentos es necesario ir

más allá de esta perspectiva para poder explicar el origen de las ventajas competitivas sostenibles.

- *La generación de ventajas competitivas sostenibles no es alcanzable:* Según la RBV una empresa genera una ventaja competitiva sostenible cuando los recursos y capacidades a su disposición son inimitables (Barney, 1991). Sin embargo, según declara Fiol (2001:692) "los recursos, las habilidades y la forma como las organizaciones los aplica cambia continuamente, lo cual lleva a la creación de ventajas que evolucionan continuamente a lo largo del tiempo". Por ello, dado que las organizaciones no son pasivas y que el entorno se encuentra en continuo cambio, la clave para generar ventajas competitivas se encuentra realmente en el nivel dinámico. Es decir, se encuentra en la generación de capacidades dinámicas y de aprendizaje organizativo (D´Aveni, 1994; Martin, 2000;). Este tipo de capacidades son las que permiten a las organizaciones adaptarse a los cambios más rápido que la competencia (Fiol, 2001).

La RBV no constituye una teoría de la organización: Los primeros autores que plantearon que la RBV podría representar una nueva teoría de la organización fueron Conner (1991) y Kogut y Zander (1992). Según estos autores, la RBV apuntaba a convertirse en una teoría diferente a la ya consolidada *"Teoría de Costes de Transacción" (Transaction Cost Economy; Williamson and Winter, 1991)*. Sin embargo, en los posteriores trabajos en los que se analizaba el valor del conocimiento como recurso estratégico clave para las organizaciones (Por ejemplo: Barney, 1996; Foss, 1996a, 1996b; Kogut y Zander, 1996; Grant, 1996; Spender, 1996) surgen las dudas sobre esta consideración. Según Foss (1996), la RBV es insuficiente para ser considerada una teoría, más bien, ésta complementa parte de las limitaciones señaladas en teoría previas como es el caso de la TCE (Barney, 1999; Mahoney, 2001; Priem y Butler, 2001a).

- *El VRIO aunque es necesario, no es suficiente para explicar la RBV:* De acuerdo con Barney (1994) uno de los argumentos claves de la RBV es que

las organizaciones para poder generar ventajas competitivas sostenibles, los recursos de que disponen deben ser valiosos, raros, inimitables y explotados por la organización. Sin embargo, esta asunción ha generado dos críticas que versan no sólo sobre la metodología, sino también sobre las proposiciones que plantea este postulado. En primer lugar, autores como Armstrong y Shimizu (2007), y Newbert (2007) plantean que las investigaciones empíricas llevadas a cabo sobre el concepto han generado apoyo empírico modesto, lo cual implica que otros factores deben ser considerados a la hora de explicar la generación de ventajas competitivas sostenibles. En segundo lugar, en lo que respecta a la asunción que hace la RBV sobre el desarrollo de ventajas competitivas sostenibles, varios autores (Por ejemplo: Grant, 1996a; Kor and Leblebici, 2005; Teece, 2007) plantean que lo que importa no es sólo el valor individual de los recursos, sino también la generación de sinergias entre las capacidades poseídas. Asimismo, otros académicos critican el poco reconocimiento que la RBV hace del carácter emprendedor y de los modelos mentales que los individuos puedan poseer (Foss et al., 2008; Foss et al., 2007; Mahoney, 1995).

- *El valor de los recursos es demasiado indeterminado como para proveer una teoría útil:* Se observa que la RBV tiene una tendencia tautológica, así como un problema con la definición de valor (Priem y Butler, 2001). Por ejemplo, Bowman y Ambrosini (2000) intentan definir el valor y para ello sugieren 3 conceptos: el valor de uso percibido (la percepción del valor por parte de los clientes), el valor monetario total (la cantidad de dinero que los clientes están dispuestos a pagar) y el valor de cambio (lo que realmente se paga). Por otro lado, Makadok (2001) distingue entre el valor de los recursos que se realiza a priori y el valor de las capacidades que se realiza a posteriori. Priem y Butler, (2001) argumentan que éste es determinado de forma exógena por el mercado. Bajo esta falta de consenso

sobre los aspectos que determinan el valor de los recursos y capacidades es difícil establecer una medida objetiva que capture este término.

- *La definición de recurso es impracticable:* Según apunta Kraaijenbrink et al. (2010: 352) la falta de un consenso en la definición de los recursos genera dos tipos de problemas. El primero de ellos, es que no permite una clara distinción entre aquellos recursos que representan una entrada a los proceso de la organización y las capacidades que permite a estas últimas seleccionar, desplegar y organizar dichos recursos (Priem and Butler, 2001). El segundo de los problemas es que no permite distinguir como distintos tipos de recursos contribuyen de manera diferente a la generación de una ventaja competitiva sostenible (Barney y Clark, 2007).

2.2LAS CAPACIDADES DINÁMICAS

Como fruto de las limitaciones presentes en la RBV, surgieron otros enfoques que buscaban identificar los procesos que llevaban a cabo las organizaciones para explotar los recursos. En su artículo titulado "*Dynamic capabilities and strategic management*", Teece (2007) introduce el enfoque de las capacidades dinámicas con el cual, trata de explicar cómo las organizaciones llevan a cabo el desarrollo, despliegue y la protección de sus competencias. Estos autores definen una capacidad dinámica como *"la habilidad presente en las organizaciones de integrar, construir y reconfigurar las competencias internas y externas para así hacer frente a los continuos cambios del entorno"* (Teece et al., 1997:516). Este nuevo enfoque centra su atención en los factores externos a la empresa, como un elemento importante que debe tenerse en cuenta a la hora de dirigir los recursos organizativos internos de cara a la obtención de una ventaja competitiva sostenible (Easterby-Smith y Prieto, 2008). De este modo, las capacidades dinámicas enriquecen al enfoque basado en los recursos, ya que cambia la visión estática que se tenía hasta el momento de los recursos y capacidades, y explica cómo las organizaciones son capaces de generar ventajas competitivas en entornos cambiantes (Ambrosini et al., 2009).

Según establece este enfoque, las capacidades de las empresas al igual que los productos y servicios que éstas ofrecen, presentan un ciclo de vida y su evolución se ve afectada por los cambios que ocurren en el entorno competitivo (Helfat y Peteraf, 2003). Lo anterior supone que la forma en que estas capacidades avancen a la fase de declive o evolucionen favorablemente con los factores del entorno, va a depender de la capacidad que tenga la empresa de desarrollar las capacidades dinámicas necesarias que contribuyan a una evolución eficiente de sus competencias (Lavie, 2006).

Parte de los fundamentos presentes en la perspectiva de capacidades dinámicas tienen sus orígenes en los trabajos de Winter sobre rutinas organizativas (Por ejemplo: Nelson y Winter, 1982; Winter, 1995). En estos trabajos, Winter argumenta que a pasar que los recursos son importantes para la generación de ventajas competitivas, estos por sí solo no son suficientes. Por ello, las organizaciones necesitan poseer y además, ser capaces de desarrollar rutinas o redes de colaboración por medio de las cuales los recursos puedan ser coordinados y desplegados (Winter, 1995; Oliver y Holzinger, 2008).

La importancia adquirida por las capacidades dinámicas ha traído un creciente número de publicaciones que abordan el tópico (Por ejemplo: Nelson, 1991; Teece y Pisano, 1994; Teece et al., 1997; Zahra, 1999; Eisenhardt y Martin, 2000; Ambrosini y Bowman, 2009; Ambrosini et al., 2009). Muestra de ello son el gran número de definiciones que ha recibido el concepto (Ver Tabla 2.1). Sin embargo, pese al gran interés prestado a este enfoque, la investigación empírica sobre capacidades dinámicas aún se encuentra en su desarrollo (Newbert, 2007; Easterby-Smith y Prieto, 2008; Barreto, 2010).

Tabla 2.1 Principales definiciones de capacidades dinámicas

Autores	Definición de Capacidades Dinámicas
Iansiti y Clark (1994: 563)	"Capacidad de la organización de nutrir, adaptar y regenerar constantemente su base de conocimiento y de desarrollar y mantener las capacidades organizativas que traducen esa base de conocimiento en acciones útiles"
Teece y Pisano (1994: 541)	"Subconjunto de competencias o capacidades que permiten a la empresa crear nuevos productos y procesos, respondiendo así a circunstancias cambiantes del mercado"
Teece et al. (1997: 516)	"Habilidad de la empresa para integrar, construir y reconfigurar sus competencias internas y externas para adecuarse a entornos de rápido cambio (…), reflejan la habilidad organizativa de lograr nuevas e innovadoras formas de ventaja competitiva"
Eisenhardt y Martin (2000: 1.107)	"Procesos de la empresa que utilizan recursos – específicamente los procesos para integrar, reconfigurar, adquirir y liberar recursos – para ajustarse a, e incluso crear, cambio en el mercado. Las capacidades dinámicas, por lo tanto, consisten en rutinas organizativas y estratégicas mediante las que las empresas logran nuevas configuraciones de recursos según los mercados emergen, colisionan, se dividen, evolucionan y mueren"
Makadok (2001: 388)	Pone de manifiesto la "importancia de un mecanismo alternativo de generación de rentas (schumeperianas), denominado construcción de capacidades, distinto de la selección de recursos" (obtención de rentas ricardianas)
Zollo y Winter (2002: 340)	"Patrón aprendido de actividad colectiva mediante el cual la organización sistemáticamente genera y modifica sus rutinas operativas para conseguir una mayor rentabilidad"
Helfat y Peteraf (2003: 997)	"Por definición, las capacidades dinámicas implican adaptación y cambio, porque construyen, integran o reconfiguran otros recursos o capacidades"

Winter (2003: 991)	"Aquéllas que intervienen para extender, modificar o crear capacidades ordinarias"
Zahra et al. (2006: 921)	"Habilidad dinámica de cambiar o reconfigurar las capacidades organizativas existentes de la empresa"
Ng (2007: 1.486)	"Se refieren a la habilidad de las organizaciones de desarrollar y buscar nuevos recursos y configuraciones que se ajusten a las condiciones cambiantes del mercado"
Teece (2007: 1.319-20)	"Capacidades de la empresa, difíciles de imitar, necesarias para adaptarse a clientes cambiantes y a las nuevas oportunidades tecnológicas. También incluyen la capacidad de la empresa de configurar el entorno en el que opera, desarrollar nuevos productos y procesos y diseñar e implementar modelos de negocio viables".
Wang y Ahmed (2007: 35)	"Orientación en el comportamiento de la empresa hacia la continua integración, reconfiguración, renovación y recreación de sus recursos y capacidades y, más importante, al incremento y reconstrucción de sus capacidades esenciales en respuesta a un entorno cambiante para conseguir mantener la ventaja competitiva"
Danneels (2008: 519-20)	"Habilidad de desarrollar nuevas capacidades". Las define como "capacidades de segundo orden" que, en términos de aprendizaje organizativo, consisten en "la habilidad de la empresa de involucrarse en exploración" de nuevo conocimiento
Oliver y Holzinger (2008: 497)	"Se refieren a la habilidad de las empresas de mantener o crear valor mediante el desarrollo y despliegue de competencias internas que maximicen la congruencia con los requerimientos de un entorno cambiante"
Helfat y Winter (2011: 1.244)	"Una capacidad dinámica es aquélla que permite a la empresa modificar la forma en la que se gana la vida actualmente"

Fuente: Adaptado de Cruz-González, Navas-López, López-Sáez y Delgado-Verde (2011: 388-9)

Si analizamos cada una de las definiciones que ofrece la literatura sobre capacidades dinámicas podremos distinguir un elemento común y es la idea de cambio de las capacidades organizativas (Cruz-Gonzáles et al., 2011). Esta idea de cambio se puede decir que es la principal diferencia de este enfoque respecto al enfoque tradicional de RBV que examinamos en el apartado anterior. Por ejemplo, Helfat y Winter (2011) en su discusión teórica acerca de la distinción entre capacidades operativas y capacidades dinámicas, estos autores establecieron que la diferencia radica en que estas últimas permiten llevar un cambio, aunque dicho cambio en ocasiones puede ocurrir de manera gradual. Esto último hace que la línea que separa ambos conceptos sea poco visible (Cruz-Gonzáles et al., 2011).

No obstante, la cuestión central que se plantea a partir de este razonamiento es cómo logran las empresas modificar sus capacidades organizativas para adaptarse en los entornos dinámicos. Sobre este respecto autores como Zander and Kogut (1995) y Grant (1996) sugieren que las capacidades organizativas surgen a partir de la integración o combinación del conocimiento disponible en el interior de la empresa lo cual, las convierte en manifestaciones de conocimiento tácito y colectivo difíciles de imitar. Considerando lo anterior, la clave para el desarrollo de capacidades dinámicas radica en la reconfiguración del conocimiento organizativo a partir del cual se generan las capacidades de la empresa (Eisenhardt y Martin, 2000) o mejor dicho, del nivel de aprendizaje desarrollado (Sirmon et al., 2007; Bingham y Davis, 2012). De este modo, la concepción del dinamismo del entorno en el análisis de las estrategias empresariales hace que la atención se traslade hacia el aprendizaje organizativo como proceso estratégico clave y no en el carácter estático del conocimiento que era concebido en la perspectiva tradicional de los recursos y capacidades (Zollo y Winter, 2002; Lavie, 2006).

Son varios los autores que subrayan el papel central que juega el aprendizaje organizativo en el desarrollo de capacidades dinámicas

(Madhok y Osegowitsh, 2000; Eisenhardt y Martin, 2000; Easterby-Smith y Prieto, 2008; Sirmon et al., 2007). Por ejemplo, Eisenhardt y Martin (2000) afirman que la forma en que las organizaciones gestionan los recursos basados en conocimiento es crítica para el desarrollo de capacidades dinámicas. Sirmon et al. (2007) proponen que en los entornos dinámicos, el aprendizaje ayuda a las organizaciones a adaptarse y mantener una posición favorable en su entorno. Por otro lado, Chirico y Salvato (2008) resaltan que "la base del concepto de capacidades dinámicas radica en las nociones de conocimiento organizativo y recombinación de conocimiento" (2008: 169). Asimismo, Lichtenthaler (2009) señala que las capacidades dinámicas dependen de los procesos de aprendizaje que son llevados dentro de las organizaciones. Otra forma de ver la relación entre ambos conceptos es mediante su efecto conjunto sobre la innovación (Danneels, 2002). En esta línea, Bingham y Davis (2002) establecen que el aprendizaje organizativo constituye el medio fundamental que permite a las organizaciones generar innovaciones, mediante la adaptación de los entornos y mediante el aprovechamiento de las oportunidades presentes en el mercado.

2.3 EL APRENDIZAJE ORGANIZATIVO

El concepto o idea de aprendizaje organizativo ha estado presente en nuestra literatura desde hace décadas. Sin embargo, sólo ha sido ampliamente reconocido en los últimos años (Easterby-Smith y Araujo, 1999). Este concepto ha sido abordado ampliamente en las investigaciones de áreas como son los recursos humanos, de la gestión estratégica y de la tecnología (Jones y Hendry, 1994; Kamoche y Mueller, 1998; Simon, 1947; Penrose, 1959; Hayek, 1989). De acuerdo con Easterby-Smith et al. (1998: 259) las razones por las cuales este concepto ha tomado gran relevancia en la literatura sobre estrategia se puede clasificar en tres: los continuos cambios de los entornos tecnológicos, la intensidad de la competencia y la globalización. Aunque la anterior clasificación varía desde el punto de

vista en que se examine (Chiva y Alegre, 2009; Dodgson, 1993), varios de los académicos que han abordado esta temática coinciden en que el éxito de las organizaciones depende en gran medida de su habilidad de aprender de su entorno.

De acuerdo con Argyris y Schön (1996: 180) la literatura sobre aprendizaje en las organizaciones tiene dos vertientes: la primera de ellas tiene una orientación más práctica y prescriptiva y es denominada como **la organización que aprende** *(the learning organization*) y la segunda considerada más escéptica y descriptiva y que se reconoce como **aprendizaje organizativo** *(organizational learning)*. La primera de ellas se centra en los factores que promueven el aprendizaje y la segunda en el proceso en sí de aprendizaje (Argyris y Schön, 1996; Chiva, 2004; Chiva y Alegre, 2009). De acuerdo con Tsang (1997), aunque ambos tienen definiciones distintas, existe un aspecto clave que marca la relación entre ellos y es que una organización que aprende es aquella que es buena en el desarrollo de aprendizaje a nivel organizativo.

El aprendizaje organizativo constituye el proceso por medio del cual las organizaciones realizan modificaciones a las bases existentes de conocimiento, a los modelos mentales de los individuos que las conforman, a las reglas y a los procesos organizativos con el fin de mejorar su desempeño (Argyris y Schön, 1978; Hedberg, 1981; Senge, 1990, Jerez-Gómez et al., 2005). Para que se provoque esta modificación es importante el contexto social en que se desarrolla, ya de este dependerá la creación de creencias comunes (Chiva y Alegre, 2005).

Las investigaciones en esta área se centran principalmente en examinar el proceso que las organizaciones siguen para poder aprender. En un principio, existían dos explicaciones fundamentales sobre cómo las organizaciones aprenden (Cohen y Levinthal, 1990; Cook y Yanow, 1996; Easterby-Smith et al., 1998): la perspectiva individual o cognitiva y la perspectiva social. A continuación, describimos en más detalle ambas

perspectivas del aprendizaje.

2.3.1 Perspectiva individual

Según explican Chiva y Alegre (2005), la perspectiva individual considera el aprendizaje como un fenómeno individual y consecuentemente entiende que las organizaciones aprenden a través de las personas (Por ejemplo: Huber, 1991). De acuerdo con Cook y Yanow (1996), en esta perspectiva se puede distinguir claramente dos orientaciones: la primera centrada en el aprendizaje individual en un contexto organizativo y la segunda emplea el aprendizaje individual como modelo para entender determinados tipos de actividades colectivas. En la primera de estas orientaciones, el aprendizaje organizativo es concebido como una forma de aprendizaje llevado a cabo por los individuos que la forma (por ejemplo: March y Olsen, 1976; Etheredge and Short, 1983; Huber, 1991; Levinthal y March, 1993).

En la segunda de estas orientaciones se establece que el aprendizaje organizativo ocurre cuando ciertas personas claves en la organización aprenden, lo cual es considerado como una de las principales causas de los cambios en los procesos y en las formas de hacer las cosas (Hedberg, 1981; Gahmberg, 1980).

Estas dos orientaciones o formas de ver el aprendizaje desde el punto de vista cognitivo han recibido ciertas críticas. Por ejemplo, Sanchez y Heene (1997) sugieren que el conocimiento y el aprendizaje organizativo no pueden ser entendidos adecuadamente si proyectamos simplemente sobre las organizaciones conceptos prestados de estudios de conocimiento y aprendizaje individual. Según estos autores, debería ser la organización en vez de los individuos la que se encuentre como objeto de estudio. En la misma línea, Cook y Yanow (1996) plantea que esta forma de concebir el aprendizaje presenta limitaciones al no establecer una clara separación de qué representa aprendizaje individual y qué aprendizaje organizativo. Por

lo cual, aunque los individuos y las organizaciones requirieran las mismas capacidades cognitivas para aprender, ello no implicaría que ambos grupos aprendieran de la misma manera (Cook y Yanow, 1996: 9).

2.3.2 Perspectiva social

La perspectiva social a diferencia de la individual, se centra en la forma en que las personas le dan sentido a sus experiencias en la organización, las cuales pueden proceder de fuentes explícitas o implícitas (Easterby-Smith y Araujo, 1999). En esta perspectiva, el aprendizaje es concebido como algo que emerge de las interacciones sociales, lo cual permite tener una mayor compresión del entorno que envuelve a las organizaciones (Gherandi et al., 1998).

De acuerdo con Easterby-Smitm et al., (1999), esta perspectiva incluye a su vez tres formas de ver el aprendizaje: como construcción social (Brown y Duguid, 1991), como proceso político (Coopey, 1994) y como proceso cultural de la organización (Lave y Wenger, 1991; Cook y Yanow, 1993). No obstante, cada una de estas formas se encuentra relacionada (Chiva y Alegre, 2005).

Uno de los trabajos pioneros en la concepción como proceso cultural es el trabajo de Cook y Yanow, 1993). Estos autores conciben aprendizaje organizativo como *"la capacidad de una organización de aprender a hacer lo que hace, es decir, la capacidad de obtener el know-how necesario para sus actividades colectivas"* (Cook y Yanow, 1993: 13). Por lo cual, cuando una organización adquiere el conocimiento que necesita para seguir llevando a cabo una actividad colectiva, este hecho se concibe como aprendizaje organizativo.

Según establecen Cook y Yanow (1993), aunque el término aprendizaje procede de un ámbito individual, ello no implica que el aprendizaje individual y el organizativo tengan que ser similares en sus procesos. En ese sentido, declaran que lo que hacen las organizaciones para aprender es muy diferente a lo que hacen las personas. En la concepción social el

aprendizaje organizativo no representa una actividad necesariamente cognitiva, sino que proviene principalmente de habilidad de gestionar los atributos y recursos que posee a su disposición (Sanchez y Heene, 1997; Cook y Yanow, 1993). En consecuencia, se plantea la idea de cultura organizativa como base para el entendimiento del aprendizaje organizativo.

La perspectiva social o cultural presenta una serie de aspectos que la distinguen de la individual. En primer lugar, esta perspectiva permite tener una concepción más sencilla de la organización ya que resulta más fácil definir la organización basados en el comportamiento de grupos que de los individuos. En segundo lugar, concibe el aprendizaje organizativo como el resultado de las actividades llevadas a cabo en el grupo y a nivel de individuo. En tercer lugar permite sentar las bases para distinguir el aprendizaje organizativo del individual, lo cual coloca al grupo y a la organización como objeto de estudio. Por último, permite concebir el aprendizaje como una actividad que se preserva e innova (Cook y Yanow, 1993).

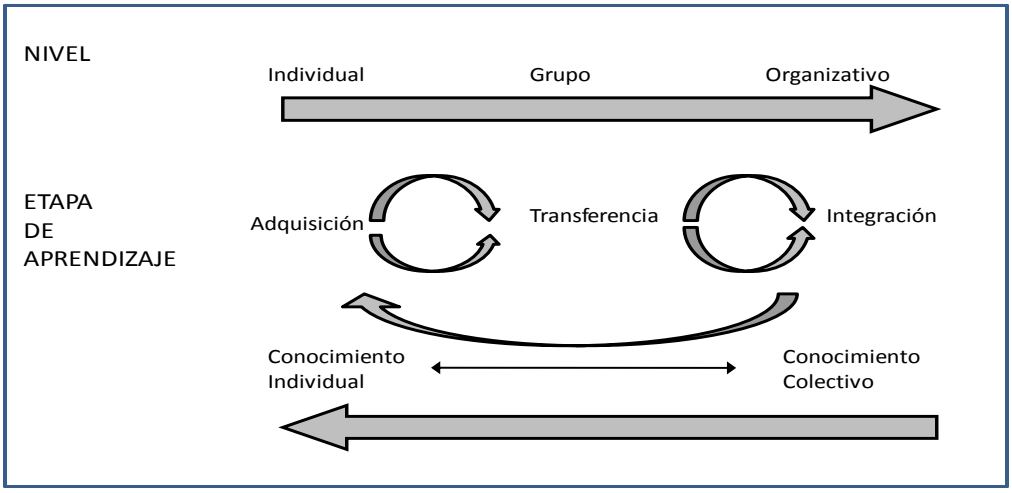
2.3.3 El aprendizaje como un proceso dinámico

Las dos perspectivas antes indicadas dieron cabidas a nuevas formas de ver el aprendizaje en las organizaciones. Algunos trabajos recientes tratan de combinar ambas perspectivas y consideran el aprendizaje **como un proceso que permite a las organizaciones aprender** (Sun, 2003; Jerez-Gómez et al., 2005; Alegre y Chiva, 2008; Chiva y Alegre, 2009). Según estos trabajos, el aprendizaje organizativo es visto como un proceso dinámico que tiene como base el conocimiento, lo cual implica que el conocimiento se mueve desde el nivel individual, al grupal y que una vez llegado al nivel organizativo, se retransmite nuevamente por los distintos niveles de la organización (Crossan et al., 1999; Jerez-Gómez et al., 2005).

La figura 2.2 muestra cómo se lleva a cabo este proceso dinámico de aprendizaje.

En un primer lugar, la adquisición de conocimiento es realizada en un primer lugar por los individuos que forman las organizaciones. Estos a través del intercambio y la continua interacción con otros miembros de la organización crean un conocimiento colectivo que luego pasa a formar parte de la memoria organizativa (Hedberg, 1981; Walsh y Ungson, 1991). Dicho conocimiento almacenado tiene un impacto en el tipo de conocimiento que las organizaciones luego adquieren y en la manera como el conocimiento nuevo debe ser interpretado y transferido. Es por ello que se considera que lo aprendido a nivel individual en las organizaciones, depende en gran medida de la base común de conocimiento que existe dentro de la empresa (Simon, 1991).

Figura 2.2 Proceso de aprendizaje organizativo



Fuente: Jerez-Gómez et al. (2005)

Jerez-Gómez et al. (2005: 717) en su planteamiento sobre los procesos de aprendizaje de las organizaciones señala tres elementos esenciales que caracterizan a dichos procesos:

En primer lugar, la adquisición o creación de conocimiento, así como su diseminación e integración dentro de la empresa, representan recursos

estratégicos claves (Zander y Kogut, 1995; Grant, 1996). Por ello, el aprendizaje organizativo tiene una naturaleza colectiva que va más allá de las capacidades individuales.

En segundo lugar, la creación y diseminación de conocimiento nuevo implica la existencia de cambios constantes los cuales pueden darse tanto a nivel cognitivo como del comportamiento (Fiol y Lyles, 1985).

En tercer lugar, los cambios internos antes mencionados conducen a procesos de mejora constante que permite a las organizaciones mantener o incrementar el rendimiento de las acciones actuales (Fiol y Lyles, 1985; Slocum et al., 1994) e incluso desarrollar ventajas competitivas (Mahoney, 1995; Brenneman et al., 1998).

2.4 LA CAPACIDAD DE ABSORCIÓN

2.4.1 Definición del concepto

El concepto de capacidad de absorción (CA) fue introducido en 1989 por Cohen y Levinthal en su artículo "Innovation and learning: the two faces of R&D". En este lo definen como una habilidad que permite a las organizaciones reconocer, asimilar y aplicar el nuevo conocimiento. Para ellos el nivel de inversión que las empresas realizan en actividades de I + D, es lo que les permite identificar las ventajas tecnológicas del entorno y apropiarse de ellas, conduciendo con ello a una mayor facilidad para aprender del nuevo conocimiento. A partir de esta relación encontrada, establecen la inversión en I + D como el factor clave para facilitar el aprendizaje y por ende el desarrollo de la CA a nivel organizativo.

En su artículo de 1990 "*Absoptive capacity: an new perspective on learning and innovation*" estos autores readaptan la definición inicial y la conectan con la habilidad de aplicar el conocimiento con fines comerciales. De manera similar a su trabajo previo, consideran la CA como un concepto formado por tres dimensiones esenciales: la capacidad de identificar, asimilar y

aplicar el nuevo conocimiento con fines comerciales. Sin embargo, en este consideran que la CA desarrollada no solo representa el producto de la inversión en I + D, sino que también el conocimiento previo y los mecanismo organizativos que facilitan la comunicación y la forma de compartir este conocimiento, influirán en su desarrollo.

Para ellos, la base de conocimiento previo permite a las organizaciones identificar en el ambiente externo aquel conocimiento que es importante para sus procesos. En ese sentido plantean que, mientras mayor sea el grado de relación que guarde el conocimiento externo con el existente en la organización, más fácil será para estas últimas identificar y asimilar el conocimiento externo. Dada estas condiciones, la capacidad de las organizaciones para identificar y asimilar conocimiento nuevo del entorno estará limitada a la cantidad de CA acumulada en un período previo y a la posesión de una experiencia relacionada (Cohen y Levinthal, 1990). No obstante, tanto para la identificación como para la aplicación efectiva del conocimiento serán necesarias estructuras de comunicación que faciliten el intercambio de información, tanto con el ambiente externo como con las distintas unidades de la organización.

Posterior a los trabajos antes citados de Cohen y Levinthal (1989, 1990) (ver tabla 1), varios académicos abordan la temática en sus análisis a diferentes niveles de la organización, sin modificar la definición original de Cohen y Levinthal o modificando ligeramente las dimensiones propuestas por estos autores. Lo que hacen estos autores es limitar las dimensiones originales del concepto a dos. La primera, ligada a la habilidad de identificar información valiosa en el ambiente externo y de posteriormente, combinarla con la base de conocimiento existente, (capacidad de reconocer, identificar, monitorear o asimilar el conocimiento externo). La segunda, relacionada con la transferencia del conocimiento adquirido a nivel interno para así facilitar su posterior implementación (capacidad de comunicar y aplicar). Por ejemplo, Arbussà y Coenders

(2007), basados en los trabajos previos de Arora y Gambardella (1994) y de Cassiman y Veugelers (2005), consideran dos dimensiones del concepto: capacidad de escanear y capacidad de integrar el nuevo conocimiento. Estos autores emplean como aproximación del término las actividades de I + D y los procesos de innovación de las organizaciones. Además, estos autores relacionan la primera dimensión del concepto con la capacidad de identificar conocimiento tecnológico no complejo, y la segunda con la capacidad de integrar en sus actividades conocimiento tecnológico más distantes o de carácter tácito.

George et al., (2001) consideran sólo dos de las dimensiones propuestas por Cohen y Levinthal (1990), y las miden tomando en cuenta los gastos en I + D (capacidad de valorar) y las patentes (capacidad de aplicar). En otro estudio, Murovec y Prodan (2009) la definen basados en el tipo de innovación que la CA organizativa es capaz de generar (CA impulsada por la demanda y CA desarrollada por la ciencia). Sin embargo, a diferencia de los estudios antes citados, a parte del conocimiento tecnológico resaltan la importancia que tiene también el conocimiento de mercado para el desarrollo de esta capacidad.

La primera modificación relevante hecha tanto a la definición como a las dimensiones del concepto fue la realizada por Zahra y George (2002). Estos autores redefinen el concepto como *"el conjunto de rutinas y procesos organizativos por medio de las cuales las organizaciones adquieren, asimilan, transforman y explotan el conocimiento para producir una capacidad dinámica organizativa"* (Zahra y George, 2002: 186). De acuerdo con estos autores, la CA representa un tipo de capacidad dinámica que permite a las organizaciones readaptar continuamente la base de conocimiento y la visión estratégica de la empresa para así hacer frente a los continuos cambios que ocurren en su entorno. Estos además, consideran la CA como una estructura de cuatro dimensiones y no de tres como habían formulado Cohen y Levinthal (1990). Cada una de dichas dimensiones se

apoya mutuamente para conferir a las organizaciones de la capacidad necesaria para promover el cambio y la evolución organizativa. Este proceso se realiza mediante dos fases: una primera denominada capacidad de absorción potencial (PACAP), la cual comprende las dimensiones de identificar y asimilar el conocimiento; y una segunda denominada capacidad de absorción realizada (RACAP), formada por las dimensiones de transformar y aplicar el conocimiento.

Según Zahra y George (2002) ambos subgrupos presentan funciones separadas pero que a la vez son complementarias. Por ejemplo, una organización puede presentar altos niveles de PACAP, sin embargo este simple hecho no proporciona a la organización la habilidad de aplicar dicho conocimiento. Asimismo, las organizaciones necesitan desarrollar la capacidad para identificar e integrar el nuevo conocimiento con el ya existente para así, aplicar las nuevas ideas a los productos o servicios que ofrece. Basados en este argumento, Zahra y George (2002) introducen el concepto de factor de eficiencia, con el que resaltan la importancia de llevar a cabo un balance adecuado de ambos subgrupos de capacidades para el desarrollo de ventajas competitivas.

Otro aspecto relevante del nuevo modelo introducido por estos autores, es la especial atención que le prestan a los factores impulsores *(activation triggers)* y a los mecanismos de integración social, como elementos que facilitan los procesos de transferencia de conocimiento a nivel interno de las organizaciones.

Posterior al trabajo de Zahra y George (2002), la revisión realizada por Lane et al. (2006) representa otra de las principales contribuciones hechas al concepto (Easterby-Smith *et al.*, 2008, Lichtenthaler, 2009, Camisón y Forés, 2010). En dicho trabajo Lane et al. (2006) llevan a cabo un análisis exhaustivo de 289 artículos publicados sobre el concepto. Dicho análisis arroja luz sobre dos problemáticas vigentes en la teoría: primero, que la mayor parte de los artículos han utilizado el concepto sin discutir ni

profundizar sobre los aspectos centrales; y segundo, que el término ha sido utilizado de una manera reducida.

Para reconducir la teoría y con ello, eliminar la manera reducida en la que había sido desarrollada hasta el momento, Lane et al., (2006) proponen una nueva definición del concepto. Para ello, toman como base cinco de los artículos centrales escritos sobre el término (Mowery *et al.*, 1996, Szulanski, 1996, Dyer y Singh, 1998, Lane y Lubatkin, 1998, Koza y Lewin, 1999, Zahra y George, 2002). Según establecen, la CA constituye una capacidad que concede a las organizaciones la habilidad de utilizar el conocimiento externo a través de tres procesos secuenciales: *(1) reconocer y entender el valor potencial del nuevo conocimiento fuera de la organización a través del aprendizaje explorador, (2) asimilar el conocimiento nuevo valioso a través del aprendizaje transformador y (3) usar el conocimiento asimilado para crear nuevo conocimiento y salidas comerciales a través del aprendizaje explotador* (Lane et al., 2006: 856). Con esta nueva definición, contribuyen a reconectar el término con las dimensiones originales introducidas por Cohen y Levinthal (1990) y además, con los procesos de aprendizaje que permiten el desarrollo de dichas dimensiones. Todo ello contribuye a afianzar el carácter multidimensional del concepto (Lane et al., 2006).

En otra importante contribución, Todorova y Durisin (2007) traen a relieve algunas críticas a la re-conceptuación realizada por Zahra y George (2002) al término de CA. Estos autores consideran que la definición de Zahra y George (2002) deja a un lado varios de los aspectos centrales originalmente propuesto por Cohen y Levinthal (1990) y de las contribuciones realizadas sobre aprendizaje organizativo e innovación. Ellos proponen un ajuste sobre dos aspectos del modelo de Zahra y George (2002): los componentes de las AC y los factores contingentes.

De los componentes propuestos en el modelo de Zahra y George (2002), ellos critican la redefinición de la primera dimensión del concepto original

reconocer el valor (*recognizing the value*) por el término **adquisición** *(adquisition)* de conocimiento externo. Según Todorova y Durisin (2007), esta nueva noción y su explicación dirigen principalmente la atención a la intensidad, rapidez y esfuerzo en obtener conocimiento y pasa por alto las trampas de no ser capaz de ver o entender el conocimiento externo del todo. Asimismo, tomando como base las investigaciones realizadas sobre psicología cognitiva y aprendizaje, consideran que la dimensión de **transformación** debe ser considerada como un proceso alterno a la dimensión de **asimilación** y no continuo a esta última. Estos autores consideran que en la medida en que el conocimiento nuevo encaje con los modelos cognitivos previos, dicho conocimiento sólo necesita ser ligeramente modificado para que pueda ser asimilado utilizando los sistemas actuales. No obstante, cuando el conocimiento a adquirir se encuentra muy alejado de los modelos cognitivos existentes, las estructuras mentales deben ser adaptadas y transformadas para así facilitar la combinación del conocimiento nuevo con el ya existente.

En cambio, cuando el conocimiento nuevo es demasiado distante de los modelos cognitivos ya existentes, las estructuras mentales deben ser adaptadas y transformadas para que el componente novedoso del conocimiento pueda ser incorporado (Todorova y Durisin, 2007).

Por último, estos autores consideran que se debe revisar la definición y el alcance de los dos subgrupos de CA propuestos por Zahra y George (2002) (PACAP y RACAP), ya que su papel en el desempeño de las organizaciones no está del todo claro. Por ello es necesario aclarar los conceptos en términos de contenido y de su contribución a la creación de valor. A diferencia de Todorova y Durisin, (2007), Camisón y Forés (2010) consideran que la principal limitación presenten en la re-conceptuación realizada por Zahra y George (2002) tiene su origen en el uso de la condición de complementariedad para describir la relación entre las cuatro dimensiones (adquisición, asimilación, transformación y aplicación) del

constructo y entre sus dos componentes (PACAP y RACAP). De acuerdo con Camisón y Forés (2010), la distinción teórica entre PACAP y RACAP sugiere que el conocimiento nuevo que es adquirido debe pasar diversos procesos interactivos antes de ser exitosamente aplicado. Por ello, una organización que desea promover el desarrollo de procesos de CA podría presentar dificultades si no promueve el avance de ambos componentes. Basándose en el análisis de los diversos factores que conforman las dimensiones de CA, estos la definen como "*Una capacidad dinámica sistemática que existe como dos subgrupos: capacidad de absorción potencial (PACAP) y capacidad de absorción realizada (RACAP)* (Camisón y Forés, 2010).

Algunos trabajos recientes también han contribuido a esclarecer el vínculo la CA con áreas muy cercanas como son el aprendizaje organizativo (Sun y Anderson, 2010) y la gestión del conocimiento (Sun, 2010). Desde su introducción, el concepto de CA ha sido conectado con nociones de aprendizaje organizativo (Cohen y Levinthal, 1990; Szulanski, 1996; Veugelers y Kesteloot, 1996; Kim, 1998; Lane y Michael, 1998; Lane *et al.*, 2001). Sin embargo, la naturaleza precisa de su relación no ha sido del todo establecida (Sun y Anderson, 2010). La relación de los dos conceptos es bastante aparente en el estudio de Cohen y Levinthal, (1990). No obstante, en ninguna parte de su artículo los autores discuten explícitamente la relación entre los dos conceptos o los distinguen.

Aunque trabajos recientes han contribuido a arrojar luz sobre el gap antes señalado, al mostrar que las dimensiones de CA son creadas a partir de procesos de aprendizaje (Por ejemplo: Lane *et al.*, 2006, Lichtenthaler, 2009), estos trabajos no explican en detalle la naturaleza de esta relación o de integrar la teoría reciente sobre CA con los abundantes modelos de aprendizaje organizativo. En su trabajo, Sun y Anderson (2010) proponen una integración del modelo de aprendizaje organizativo 4I presentado por

Crossan et al., (1999) y de la re-conceptuación de CA propuesta por Zahra y George (2002).

La esencia de su argumento se basa en que la CA debería ser considerada como un tipo específico de aprendizaje organizativo concerniente a la relación de la organización con el conocimiento externo. Ellos ven cada dimensión de la CA como una capacidad de aprendizaje generada por procesos específicos de aprendizaje socio-psicológicos, los cuales son influenciados por los factores bases de la organización (Sun y Anderson, 2010: 15). Estos autores consideran que cada una de las capacidades es generada a diferentes niveles de aprendizaje (individual, grupal, organizativo) y la combinación de estas capacidades de aprendizaje dota a la organización de una capacidad dinámica final para responder a los cambios estratégicos.

Tabla 2.2. Principales definiciones y contribuciones hechas a la medición de la capacidad de absorción

Autores	Definición	Dimensiones	Modelo de medida	Contextos	Aportaciones a los modelos	Medidas
Cohen y Levinthal (1990)	Capacidad de valorar, asimilar y aplicar el conocimiento nuevo con fines comerciales	Valorar, asimilar y aplicar	Una dimensión	Organizativo	Cohen y Levinthal (1989, 1990), Mowery et al. (1996)	Intensidad en I + D
			Dos dimensiones	Organizativo, inter-organizativo, individual y equipo	Arora y Gambardella (1994), Cassiman y Veugelers (2005), George et al., (2001), Liao et al., (2003), Murovec y Prodan (2009)	Base de conocimiento existente, tipo de conocimiento externo, Conocimiento relacionado, comunicación interna
			Tres dimensiones	Organizativo, inter-organizativo	Lane y Lubatkin (1998), Lane et al. (2001), Jantunen (2005) García-Morales et al., 2008	Base de conocimiento, similitud de los modelos y estructuras, nivel de motivación, habilidades del personal, dimensiones del concepto
Zahra y George (2002)	Conjunto de rutinas organizativas y procesos estratégicos por medio de los cuales las organizaciones adquieren, asimilan, transforman y explotan el conocimiento con el fin de crear valor.	Adquirir, asimilar, transformar y explotar	Cuatro dimensiones	Organizativo, inter-organizativo	Jansen et al., (2005), Liao et al. (2003), Fosfuri y Tribó (2008), Lev et al. (2009), Sun y Anderson (2010)	Base de conocimiento previo, mecanismos de integración social, confianza, características de las estructuras organizativas, dimensiones del concepto
Lane et al., (2006)	Capacidad de reconocer , asimilar y aplicar el conocimiento nuevo a través de tres procesos de aprendizaje: aprendizaje explorador, aprendizaje transformador y aprendizaje explotador.	Reconocer-entender, asimilar y aplicar	Tres dimensiones	Organizativo	Lichthenthaler (2009)	Procesos de aprendizaje organizativo (explorador, transformador, explotador)
Todorova y Durisin, (2008)	Capacidad de reconocer el valor, asimilar/transformar y aplicar el conocimiento nuevo	Reconocer, asimilar o transformar, aplicar	Tres dimensiones	Organizativo	Todorova y Durisin (2007)	No ha sido medido

Fuente: Elaboración propia

2.4.2 Principales antecedentes y salidas

2.4.2.1 Características del conocimiento

Existen dos grandes grupos de argumentos que marcan los estudios sobre las características del conocimiento como antecedentes de la CA (Lane *et al.*, 2006). El primer grupo, se centra en ver como el tipo de conocimiento influye sobre la habilidad de las organizaciones para reconocer conocimiento valioso (conocimiento externo). El segundo, examina como la características de la base previa de conocimiento proporciona a las organizaciones la habilidad para asimilar dicho conocimiento (conocimiento interno).

El conocimiento previo ha sido reconocido como unos de los principales determinantes de la CA (Cohen y Levinthal, 1989; Lane y Lubatkin, 1998). De acuerdo con Cohen y Levinthal (1990), la habilidad de evaluar y utilizar el conocimiento externo es en gran medida una función del conocimiento previo relacionado. Esto ha llevado a varios académicos a centrar su atención en aspectos tales como la profundidad, la amplitud y la similitud del conocimiento existente, para así entender como el conocimiento es identificado y asimilado.

Una amplia profundidad de conocimiento en un área determinada provee mayor entendimiento y conduce a una mayor capacidad para absorber conocimiento nuevo de un dominio relacionado. Además, ayuda a la generación de nuevas asociaciones y a la creación de conexiones entre el conocimiento nuevo y la base de conocimiento ya existente (Sun y Anderson, 2010; Wang *et al.*, 2010). Por ello, factores tales como las habilidades en común, la estrategia, la experiencia, los aspectos culturales y las estructuras cognitivas pueden contribuir a mejorar la absorción y asimilación del conocimiento que proviene del ambiente externo (Lane y Lubatkin, 1998; Lane *et al.*, 2006; Wang *et al.*, 2010). De acuerdo con Ahuja y Katila (2001), cuando la base del conocimiento interno contiene

elementos similares al conocimiento que se quiere absorber, el proceso de identificación y asimilación es más simple. De esta forma, el aprendizaje experimental acumulado a través de las interacciones con el entorno mejora la capacidad de absorción potencial (PACAP) de las organizaciones (Fosfuri y Tribó, 2008).

Otra característica del conocimiento comúnmente estudiada en la literatura de CA es el carácter tácito del conocimiento. Algunos autores han encontrado que este último se encuentra situado en interacciones complejas, rutinas y procesos dentro de la organización, lo que contribuye a crear barreras para la imitación (Simonin, 1999; Vega-Jurado *et al.*, 2008). Este tipo de conocimiento representa un elemento relevante para crear ventajas competitivas, sin embargo su transferencia es limitada dada la dificultad de codificación.

Como la CA de las organizaciones tiende a desarrollarse de manera acumulada (Cohen y Levinthal, 1990), la experiencia de las organizaciones en la búsqueda de conocimiento puede afectar tanto la localización de la búsqueda y habilidad de identificar y asimilar conocimiento nuevo (Szulanski, 1996; Zahra y George; 2002; Fosfuri y Tribó, 2008). Una organización podría ignorar la existencia de una fuente importante de conocimiento si esta no tiene alguna experiencia relacionada con esta fuente. Del otro lado, las organizaciones tenderán a tomar ventajas de las fuentes que han utilizado en ocasiones previas (Kim y Song, 2007; Bergh y Lim, 2008; Vega-Jurado *et al.*, 2008). Esto se debe principalmente a la falta de conocimiento tácito en dicha actividad o área. En su estudio, Fosfuri y Tribó (2008) mostraron que las organizaciones cuyos empleados de I + D no habían publicado en revistas científicas, podrían ignorar la existencia de revistas especializadas donde una gran cantidad de conocimiento se encuentra públicamente disponible. Estos elementos que por generalidad son tácitos, influyen la valoración de las organizaciones del conocimiento

disponible en el entorno y es lo que hace la CA dependiente del conocimiento previo (Vega-Jurado *et al.*, 2008).

No obstante, pocos estudios han evaluado cómo las características del conocimiento influyen sobre la habilidad de las organizaciones para explotar el conocimiento asimilado (Lane *et al.*, 2006). De acuerdo con Lichtentharler, (2009), el conocimiento de mercado puede incidir significativamente en los procesos de explotación de las organizaciones, ya que provee entendimiento acerca de las funciones en las que el conocimiento tecnológico puede ser útil. Asimismo, poco se conoce acerca de cómo las organizaciones guardan y reutilizan el stock de conocimiento previo y como las características organizativas inciden sobre estas (Volberda *et al.*, 2010). La mayor parte de los estudios previos han centrado su atención en la CA organizativa (Sun y Anderson, 2010). Por ello, los estudios sobre como el conocimiento es creado o generado desde el nivel individual son escasos. La capacidad de absorción no solo depende del cruce directo con el ambiente externo, sino que depende de la transferencia del conocimiento entre las diferentes unidades e individuos que la conforman (Cohen y Levinthal, 1990; Jansen *et al.*, 2005; Minbaeva, 2005; Lane *et al.*, 2006). Por ello, aspectos como son la naturaleza y la característica del conocimiento requerido y transferido, la capacidad de absorción individual y el carácter recíproco del compañero pueden influir en el éxito de la transferencia de conocimiento entre individuos y en el desarrollo de CA (Khamseh y Jolly, 2008).

2.4.2.2 Condiciones del entorno

Lane (2006) en su estudio remarcó la importancia de que las investigaciones futuras sobre los entornos organizativos deberían tomar en cuenta no solo el entorno competitivo industrial, sino que también deberían prestar atención al entorno regulador (como son los derechos de propiedad intelectual) y al entorno del conocimiento (por ejemplo el conocimiento producido por las fuentes corporativas y no corporativas).

Aunque las organizaciones pueden parcialmente ejercer influencia sobre el ambiente externo a través del tiempo, las capacidades dinámicas dependen del contexto (Song *et al.*, 2005, Teece, 2007). Es por ello que el entorno es importante para analizar los efectos de la CA, ya que distintos entornos implican diferentes valoraciones de capacidades dinámicas.

Las organizaciones a menudo adquieren conocimiento del entorno, especialmente para responder a los entornos turbulentos, lo cual señala la importancia de la influencias del ambiente sobre las acciones estratégicas de la organización (Veugelers y Cassiman, 2005). El conocimiento disponible para responder a estos cambios puede ser tecnológico o de mercado, las investigaciones previas sobre capacidades dinámicas han distinguido dos clases de turbulencias que influyen en el ambiente de las empresas: turbulencia tecnológica y del mercado (Song *et al.*, 2005; Lichtenthaler, 2009).

Según señala Lichtenthaler (2009), la turbulencia tecnológica se refiere a la tasa de cambios tecnológicos, mientras que la turbulencia de mercado se relaciona al grado de inestabilidad y de incertidumbre dentro del mercado de una organización. En condiciones caracterizadas por diferentes niveles de turbulencia la CA presenta un efecto positivo sobre la innovación de las empresas, lo que significa que el aprendizaje explorador, transformador y explotador influyen positivamente sobre la innovación de las empresas en ajustes tanto de alta como de baja turbulencia (Lichtenthaler, 2009: 839). Esto en parte contradice los resultados de estudios previos en los que remarcan que el aprendizaje explotador tiene un efecto negativo sobre la innovación en ajustes caracterizados por altos niveles de turbulencia (Por ejemplo: Jansen *et al.*, 2005). Según señalan Jansen *et al.*, (2005) bajo condiciones de turbulencia un alto nivel de explotación interna puede llevar a las organizaciones a un sobre énfasis en los mercados y tecnología existentes, lo cual es menos valorable para los cambios rápidos del entorno. Según Lichtenthaler (2009), este argumento no es aplicable para

el aprendizaje explotador dentro del contexto de CA, ya que los riesgos de inercia organizativa son limitados cuando las organizaciones extienden su base de conocimiento interna con conocimiento externo (Lichtenthaler, 2009: 839). Las empresas no desarrollan altos niveles de aprendizaje explotador para aplicar el conocimiento asimilado, si en primer lugar presentan deficiencias de otros procesos de aprendizaje para asimilar y mantener el conocimiento externo (Lane *et al.*, 2006; Zahra y George, 2002).

Otro aspecto del entorno que puede influir sobre el desarrollo de CA en las organizaciones es el nivel de competitividad presente en el entorno en el que actúa la empresa. Cuando la competitividad del entorno se incrementa, las organizaciones tienden a desarrollar o a mejorar los recursos que poseen a través de la recolección de información referente a los cambios y mediante la adopción de estrategias o estructuras que les permitan responder a dichos cambios (Van den Bosch *et al.*, 1999). En este marco, la PACAP permite a las organizaciones crear y adquirir conocimiento nuevo y la capacidad de absorción realizada (RACAP) permite la combinación del conocimiento existente con otros recursos para así crear ventajas competitivas (Lane *et al.*, 2006; Todorova y Durisin, 2007). De acuerdo con Lev *et al.*, (2009), la competitividad afecta directamente el stock de PACAP, pero sólo impacta de forma indirecta (vía stock de PACAP) al stock de RACAP (Lev *et al.*, 2009).

2.4.2.3 Antecedentes inter-organizativos

Obtener conocimiento de fuentes externas y aprender de los aliados representan dos elementos críticos de los antecedentes inter-organizativos (Lane *et al.*, 2006; Sun y Anderson, 2010; Volberda *et al.*, 2010). Las iniciativas de cooperación inter-organizativa constituyen una de las maneras precisas de las organizaciones para identificar, transferir e interiorizar conocimiento externo. Este conocimiento externo puede consistir no solo en conocimiento tecnológico como diversos autores habían establecido previamente (Mowery *et al.*, 1996, Szulanski, 1996; Dyer

y Singh, 1998; Lane y Lubatkin, 1998; Dushnitsky y Lenox, 2005; Nooteboom *et al.*, 2007), sino que puede basarse en técnicas y prácticas de gestión, modelos de gestión de recursos humanos, estructuras organizativas, producción del saber hacer *"know how"* y experiencia sobre el mercado y el conocimiento acerca de nuevos mercados (Lichtenthaler, 2009; Camisón y Forés, 2010).

Muchos de los estudios previos que han examinado el vínculo de la CA con los antecedentes inter-organizativos se han centrado principalmente en las características del conocimiento previo o relacionado (Lane *et al.*, 2006). Sin embargo, existen otros factores vinculados a la naturaleza del conocimiento requerido y transferido, a la naturaleza de la relación y al comportamiento mutuo de los aliados, los cuales inciden sobre el éxito de la transferencia de conocimiento (Khamseh y Jolly, 2008) y por ende en el desarrollo de CA a nivel organizativo.

La naturaleza y características del conocimiento requerido y transferido

La naturaleza y el papel del conocimiento requerido por uno de los aliados a otro podrían afectar la transferencia de conocimiento particularmente a través del tipo de mecanismo requerido para su transferencia en la alianza (Khamseh y Jolly, 2008). En este caso el carácter tácito, la centralidad, el nivel de complejidad y de complementariedad del conocimiento juega un papel importante.

Muchos de los estudios en este campo se han centrado, por ejemplo, en investigar la influencia de aspectos de la cooperación sobre la innovación, pasando por alto el efecto que dichos aspectos puedan tener sobre el desarrollo de CA, o en ciertos casos, no ha sido empíricamente comprobado (Cockburn y Henderson, 1998; Koch y Strotmann, 2008; Chen *et al.*, 2009; Fabrizio, 2009). Dicha orientación de los estudios se debe principalmente a la relación recursiva entre la CA y la innovación (Lane et al., 2006).

Fabrizio, (2009) demostró que la inversión en investigación interna y la colaboración con científicos de universidades provee de beneficios de búsqueda en dos ámbitos: el ritmo de innovación y la importancia de los resultados de las innovaciones. Además, mostró que estas dos actividades de investigación son más efectivas por generar una mayor eficiencia de investigación cuando se utilizan juntas. Otros autores como Chen *et al.*, (2011) estudiaron como las relaciones de aprendizaje no solo con universidades y centros de investigación, sino también con otros aliados como son los clientes y suplidores pueden contribuir al desarrollo de un desempeño innovador.

A diferencia de los anteriores, otros académicos (Fosfuri y Tribó, 2008; Murovec y Prodan, 2009; de Jong y Freel, 2010; Spithoven *et al.*, 2010) evaluaron cómo la colaboración con tipos específicos de socios influyen sobre la CA de la organización. Estos seleccionaron no solo las organizaciones localizadas en la cadena de valor del producto o servicio, sino que también incluyeron instituciones como son las públicas o comerciales de conocimiento y las consultoras, las cuales se encuentran fuera de la cadena de valor.

Aunque varios académicos argumentan que la CA solo puede ser generada a nivel interno (Cohen y Levinthal, 1990; Zahra y George, 2002; Todorova y Durisin, 2007), estudios recientes muestran como las colaboraciones sostenidas con agentes externos pueden contribuir al desarrollo de CA, las cuales influyen posteriormente en el desempeño innovador de las organizaciones. Por ejemplo, las empresas envueltas en colaboraciones de I + D y en transacciones de I + D basadas en el mercado pueden desarrollar una fuerte habilidad para entender y asimilar el flujo de conocimiento que parte del ambiente externo, lo cual influye significativamente en su CA acumulada (Fosfuri y Tribó, 2008).

Una última variable que también ha sido considerada como determinante de los altos niveles de CA en las organizaciones es la proximidad

geográfica. Sin embargo, cuando las organizaciones necesitan servicios altamente especializados, cualificados y sofisticados, la inversión en CA puede facilitar la efectividad de la búsqueda y el alcance, a través de la reducción de la distancia cognitiva. Con ello, las organizaciones también podrían lograr eliminar algunos de los problemas que pueden surgir como fruto de la distancia geográfica entre las organizaciones (de Jong y Freel, 2010).

Factores relacionados al comportamiento mutuo de los aliados

La proximidad de las organizaciones en la toma de decisiones y las reacciones de una organización respecto a los dilemas relacionados al comportamiento de los aliados (protección del conocimiento, intención de aprendizaje, confianza) afecta la transferencia del conocimiento mediante el cambio de los niveles de confianza, apertura y los motivos de cooperación (Khamseh y Jolly, 2008). Asimismo, las diferencias culturales también pueden influir sobre los factores antes mencionados y sobre la efectividad de la transferencia de conocimiento indirectamente (Liu y Vince, 1999).

Las organizaciones tienden a establecer relaciones de aprendizaje con el fin de tener un mayor control o de amortiguar las consecuencias de las incertidumbres del mercado (Lichtenthaler, 2009, Murovec y Prodan, 2009). Una mejora en las relaciones de aprendizaje entre organizaciones puede facilitar el intercambio de información con los suplidores, el desarrollo de aprendizaje partir de las interacciones con los agentes externos y por últimos ayudar a actualizar las capacidades de I + D (Chen *et al.*, 2009).

Dentro de la relación de clientes-suplidores, el éxito de la relación de aprendizaje dependerá del deseo de ambos de cooperar en actividades conjuntas de aprendizaje (Chen *et al.*, 2009), lo cual se podría traducir en una mayor efectividad de la transferencia de conocimiento cuando las

organizaciones que intervienen en la relación de aprendizaje tienen intenciones de aprender (Minbaeva, 2005; Khamseh y Jolly, 2008; Koch y Strotmann, 2008).

2.4.2.4 Antecedentes intra-organizativos

La CA se ve influenciada por factores organizativos tales como la estructura, la cultura y la forma en la que se promueve la comunicación interna (Van den Bosch *et al.*, 1999; Minbaeva, 2005; Zhang *et al.*, 2007; Murovec y Prodan, 2009; Jabar *et al.*, 2011). La CA no constituye la simple suma de las habilidades de los empleados, más bien esta depende de la habilidad de la organización de transferir conocimiento entre los diversos departamentos, funciones e individuos (Cohen y Levinthal, 1990; Zahra y George, 2002). Algunos autores demostraron que la CA a nivel organizativo es determinada por su experiencia en organizar y estimular la distribución del conocimiento (Van den Bosch *et al.*, 1999) y por la similitud existente entre los sistemas de las compañías que cooperan (Lane *et al.*, 2006). Otros estudios, demostraron que la cultura organizativa tiene un efecto positivo sobre el nivel de CA si esta provee de incentivos para la difusión del conocimiento a través de la participación de empleados y directores (García-Morales *et al.*, 2008).

La cultura existente en la organización determina la actitud de los individuos ante el cambio y esto a su vez influye sobre la CA organizativa (Khoja y Maranville, 2009; Murovec y Prodan, 2009). En una cultura en la que se promueve el cambio continuo, los individuos estarán motivados a buscar información acerca de posibles cambios y mejoras en los procesos o productos. Sin embargo, en aquellas culturas que no promueven, los individuos se mostraran reacios a asimilar y utilizar información externa debido a que son incapaces de reconocer el valor de la información, incluso cuando ellos podrían estar al tanto de ella. Es por esta razón que una actitud positiva al cambio estará positivamente relacionada con la

obtención de una mayor capacidad de absorción (Murovec y Prodan, 2009).

En lo que respecta a la estructura organizativa, existen diferentes parámetros que determinaran su influencia sobre el desarrollo de CA. El tipo de estructura de la organización, por ejemplo (funcional, divisional o matricial) facilitará la incorporación del conocimiento nuevo y su posterior aplicación (Van den Bosch *et al.*, 1999). Además, el desarrollo de actividades de gestión de los recursos humanos que promuevan la motivación de los empleados y el desarrollo de nuevas habilidades, también puede incidir positivamente sobre la CA organizativa (Mahnke *et al.*, 2005; Minbaeva, 2005).

La formalización y los mecanismos de integración social constituyen parámetros organizativos, los cuales afectan la transferencia de conocimiento entre los individuos y entre las diversas áreas funcionales de la organización (Van den Bosch *et al.*, 1999; Zahra y George, 2002; Todorova y Durisin, 2007; Fosfuri y Tribó, 2008). En particular, los mecanismos de integración social, aparte de determinar los modelos de comunicación y la fuerza de los lazos y las redes internas, influyen sobre todos los componentes de la CA y esta influencia puede ser tanto positiva como negativa dependiendo del tipo de conocimiento y de los procesos de conocimiento involucrados (Todorova y Durisin, 2007).

Otro aspecto interno que puede incidir en el desarrollo de CA es la cognición individual (Cohen y Levinthal, 1990; Lane *et al.*, 2006; Sun y Anderson, 2010; Volberda *et al.*, 2010). Debido a la condición de dependencia lineal (*path dependent)* de la CA, la experiencia y el conocimiento previo facilitan el uso de conocimiento externo (Van den Bosch *et al.*, 1999; Liao *et al.*, 2007; Bergh y Lim, 2008). Es por ello que a través de la evaluación de los modelos individual y compartido de los miembros de la organización, se puede entender qué conocimiento es

reconocido, cómo este es transformado y combinado, y cómo es aplicado (Lane *et al.*, 2006).

De acuerdo con Fosfuri y Tribó (2008), aspectos tales como el nivel de formación y el conocimiento acumulado en la organización influyen positivamente sobre la habilidad de las organizaciones de explotar conocimiento externo (Fosfuri y Tribó, 2008; Murovec y Prodan, 2009; Schmidt, 2010). Asimismo, varios estudios señalan que la capacidad de adquirir conocimiento de las organizaciones está influenciada por el tipo de intuición que poseen los individuos, los cuales actúan como receptores del conocimiento externo (Chou, 2005; Vega-Jurado *et al.*, 2008; Sun, 2010). Según establece Sun y Anderson (2010), el tipo de modelo mental que poseen los individuos tendrá un efecto distinto sobre el aprendizaje. Por ejemplo, si la intuición se basa en la experiencia el conocimiento adquirido será incremental, ya que los individuos reconocerán sólo el conocimiento que encaje con los modelos anteriores. En cambio, si la intuición es emprendedora los individuos trataran de acceder a nuevas experiencias que les permita cambiar las creencias y asunciones previas, y traer a relieve nuevos modelos de innovación radical (Sun y Anderson, 2010).

2.4.2.5 Antecedentes de gestión

La estrategia organizativa juega un papel importante en determinar qué áreas del conocimiento son valorables y cuáles deberían ser asimiladas y aplicadas (Lane *et al.*, 2006; Easterby-Smith *et al.*, 2008; Grimpe y Sofka, 2009; Volberda *et al.*, 2010). Esta decisión puede depender de las características del entorno en que se mueva la organización, del ritmo de crecimiento, de las características del conocimiento requerido y de cómo se lleva a cabo la distribución de la toma de decisiones (Phene *et al.*, 2006; Easterby-Smith *et al.*, 2008; Grimpe y Sofka, 2009; Lev *et al.*, 2009).

La orientación estratégica constituye uno de los problemas principales que las organizaciones enfrentan en su estado de transición de ciclo

organizativo (Phene *et al.*, 2006). Ante estas situaciones las actividades de emprendimiento corporativo proporcionan a estas organizaciones un fundamento para construir y explotar las capacidades de innovación que les permita sobrevivir, alcanzar rentabilidad, y estimular el crecimiento (Phene *et al.*, 2006).

Asimismo, en los ambientes caracterizados por una innovación abierta y por competitividad del entorno, las organizaciones necesitan identificar las fuentes de conocimiento más beneficiosas y alinear su CA en torno a estas. Grimpe y Sofka (2009) señalaron que las organizaciones de los sectores de baja y alta tecnología difieren en sus estrategias de búsqueda de información y que eso media la relación existente entre las entradas y salidas de innovación. Así, las organizaciones de baja tecnología centran su estrategia de búsqueda en la información que proviene de los competidores y clientes. En cambio, para las empresas del sector de alta tecnología el uso del conocimiento de universidades y de suplidores es lo que diferencia su estrategia de búsqueda. Lev et al. (2009) evaluaron el modelo estratégico de una organización conectando la competitividad del entorno, stock de CA y desempeño y encontraron que las organizaciones gestionan ambos stocks de PACAP y RACAP en respuesta de la competitividad del entorno.

Varios autores han reconocido que el conocimiento está conectado con el poder, y que la decisión de compartir, requerir y transferir conocimiento constituye frecuentemente un acto político (Marshall y Brady, 2001; Easterby-Smith *et al.*, 2008; Sun y Anderson, 2010). El poder episódico está relacionado con actos políticos discretos que son iniciados por el propio interés del individuo, en cambio el poder sistémico es difundido a través de los sistemas sociales que constituyen la organización (Easterby-Smith *et al.*, 2008).

Ambos tipos de poder están relacionados con la CA de la empresa. Los factores políticos sistémicos influyen sobre qué información externa es accesible y quién tiene legítima autoridad para hacer uso de esta. En cambio, el poder episódico es importante cuando nuevas formas de información externa llegan a estar disponibles, las cuales no se encuentran cubiertas por los sistemas existentes. Por lo antes dicho, ambos tipos de poder inciden considerablemente sobre la dimensión de adquisición y asimilación (Sun y Anderson, 2010).

En el caso de la dimensión de explotación ocurre diferente. La dimensión de explotación representa la capacidad de una organización de incorporar el conocimiento nuevo adquirido y transformarlo dentro de sus operaciones, de manera que pueda ser continuamente refinado y explotado (Zahra y George, 2002). Dicha dimensión se ve afectada por actividades de liderazgo (sistemas de recompensas, mecanismos de reconocimiento y despliegue efectivo de recursos) que aseguran la reestructuración efectiva y a tiempo de la memoria organizativa (Sun y Anderson, 2010: 19). Los líderes para poder asegurar la continua adopción y utilización del conocimiento nuevo, necesitarán de suficiente poder episódico que les permita finalmente institucionalizar el conocimiento adquirido (Easterby-Smith *et al.*, 2008).

Una organización que establece rutinas para asegurar la transparencia en su dirección estratégica motiva a los empleados a compartir lo que saben y los motiva a buscar formas de utilizar efectivamente y de explotar la base de conocimiento existente. También, la compartición de conocimiento es generada cuando existe un amplio compromiso de los individuos con la organización. De manera que, el compromiso estratégico no sólo afecta el proceso de adquisición de conocimiento, sino que influye sobre los procesos de transferencia y uso del conocimiento (Sun, 2010).

2.4.2.6 Salidas de la capacidad de absorción

Las investigaciones sobre las salidas de la CA se han centrado principalmente en las medidas del desempeño relacionadas a la innovación, o en unos pocos casos han pasado directamente al desempeño global. Lane *et al.* (2006) en su propuesta para realinear las investigaciones sobre CA clasificaron las salidas en dos grupos: las salidas comerciales (productos, servicios y patentes) y las salidas de conocimiento (general, científico, técnico y organizativo. Algunos de los estudios recientes en esta área han evaluado como ciertos determinantes (internos o externos) de la organización influyen directamente sobre las salidas antes señaladas (Chen *et al.*, 2009; Morales *et al.*, 2008; Koch y Strotmann, 2008; Wang *et al.*, 2010). Otros en cambio, han evaluado como la CA afecta las salidas de conocimiento y comerciales de la organización (Jong y Freel, 2010; Murovec y Prodan, 2009; Lev *et al.*, 2009; Koch y Strotmann, 2008; Rothaermel y Alexandre, 2009; Lichtenthaler, 2009; Fosfuri y Tribó, 2008; Grimpe y Sofka, 2009; Tsai, 2009).

Según estos estudios, la CA (medida como stock de conocimiento, como PACAP y RACAP o como procesos de aprendizaje) influye sobre las salidas comerciales, del conocimiento de las organizaciones y del desempeño general (Lane *et al.*, 2006). Las principales salidas comerciales abordadas en las investigaciones sobre CA están relacionadas con el desarrollo o mejora de productos y servicios; la posición frente a la competencia o en el mercado; el desempeño financiero; y el desarrollo o mejora de los procesos (Koch y Strotmann, 2008; Morales et al., 2008; Lichtenthaler, 2009; Chen *et al.*, 2009; Tsai, 2009; Murovec y Prodan, 2009; Lev *et al.*, 2009; Rothaermel y Alexandre, 2010; Wang *et al.*, 2010;). En lo que respecta a las salidas del conocimiento, algunas de las principales salidas consideradas son: la disminución de la distancia cognitiva y el desarrollo o mejora de productos y servicios. Esta última, sin embargo ha sido poco tratada en la literatura (Lane *et al.*, 2006).

Las salidas antes señaladas también podrían repercutir a su vez en el desarrollo de CA a nivel organizativo. Por ejemplo, Jong y Freel (2010) señalan que la inversión en CA proporciona efectividad en la búsqueda y en el alcance de las colaboraciones a través de la reducción de la distancia cognitiva de las empresas involucradas en la colaboración. De ese modo, el conocimiento resultante permite a las organizaciones sobrellevar las barreras impuesta por las largas distancias sobre el intercambio de conocimiento. Otros estudios señalan que la experiencia de las empresas en la búsqueda de conocimiento influye positivamente en la PACAP (Fosfuri y Tribó, 2008). Debido a que la CA tiende a desarrollarse de manera acumulada (Cohen y levinthal, 1990), el conocimiento y la experiencia que las organizaciones generen en sus colaboraciones afectará su capacidad futura de identificar y asimilar conocimiento externo (Fosfuri y Tribó, 2008; Jong y Freel, 2010).

No obstante, a pesar de la importancia de estas relaciones de retroalimentación, pocos estudios han tratado dichas relaciones en detalle. Según Lane *et al*., (2006) la mayor parte de las investigaciones se centran tan sólo en un sentido de la relación y no evalúan en profundidad cómo las salidas de la CA pueden a su vez contribuir a mejorar su desarrollo.

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Capítulo 3:

Organizational Learning Facilitating Factors: An Analysis of Their Effect on Firm´s Absorptive Capacity

ABSTRACT

It has been highlighted that absorptive capacity and organizational learning present some conceptual affinity and connection. Based on this assumption and considering the process based definition of absorptive capacity, we empirically examine how different learning facilitating factors recognized in the OL literature affect exploratory, transformative and exploitative learning processes in different ways. We test our research model in a sample of 467 industrial firms from Spain. Results, suggest that promoting experimentation and risk taking are essential in increasing firm´s ability to explore, transform and exploit external knowledge. Furthermore, our results contrast previous studies that suggested a negative effect of socialization capabilities in acquiring external knowledge and show that promoting dialogue is important, not only for transforming and exploiting the new knowledge, but also it is relevant in the exploration process.

3.1 INTRODUCTION

Firms increasingly rely on external knowledge to foster innovation and to enhance their performance (Zollo et al., 2002). In this vein, absorptive capacity has been pointed as one of the essential capabilities that allow firms to generate competitive advantages from the external sources available on the environment (Lane et al., 2001; Jansen et al., 2005; Licthenthaler, 2009). According to the process-based definition, Absorptive Capacity (AC) represents a firm's ability to utilize external knowledge through the sequential processes of exploratory, transformative, and exploitative learning (Lane et al., 2006).

Although it is widely accepted that absorptive capacity is a process that is inherently organizational (Cohen and Levinthal, 1990), few empirical studies have examined empirically how specific managerial antecedents affect the learning processes behind a firm´s AC. A Review of the concept suggests that managerial antecedents are among the most important antecedents in studies on AC (Lane et al., 2006; Volberda et al., 2010). The above includes aspects related to individuals, organizational structure, policies and organizational mechanisms, which affect the distribution, integration and application of the new external knowledge (Van den Bosch et al., 1999; Minbaeva, 2005; Zhang et al., 2007; Murovec and Prodan 2009; Jabar et al., 2011). However, while the effects of managerial mechanisms have been explored in the empirical literature, the ways they contribute to the organizational learning processes associated with firm´s AC have not been fully analyzed (Jansen et al., 2005; Lichtenthaler, 2009;

Pedersen and Schleimer, 2012). Examining the aforementioned would not only clarify how absorptive capacity can be developed, but it would also reveal why firms have difficulties in managing the learning processes behind a firm's successful use of external knowledge (Sun and Anderson, 2010).

The objective of this study is to address these issues and to contribute to the existing literature in several ways. We contribute to research regarding the link between organizational facilitating factors and absorptive capacity. Based on the argument that organizational learning and absorptive capacity share similar antecedents (Sun and Anderson, 2010), we conceptually identify and empirically examine how different managerial antecedents aimed at facilitating organizational learning affect the processes of exploration, transformation and exploitation of external knowledge, and thus the generation of a firm's AC. Previous research has shown that organizational mechanisms such as combinative capabilities, innovative culture, and decentralization and relationship strength influence AC´s dimensions in specific ways (Jansen et al., 2005; Pedersen and Schleimer, 2012). However, recent revisions of the concept point the need for more studies to assess how other organizational mechanisms, related to learning, affect the dimensions of AC (Sun and Anderson, 2010; Volberda et al., 2010). The above would help to open the black box of managerial antecedents of AC by showing empirically the relative importance of specify types of organizational mechanisms and strategies in generating a firm's capability to explore, transform and exploit external knowledge.

The structure of this paper is as follows. In section 2, we provide a literature review and propose three research hypotheses. In section 3, the methodology used in the empirical study and the characteristics of the sample data are described. In section 4, the results obtained are described. Finally in section 5 the conclusions and implications are discussed.

3.2 THEORETHICAL BACKGROUND AND HYPOTHESES

In the literature, several elements have been highlighted as antecedents or determinants of a firm´s AC. According to Lane et al. (2006) the antecedents of AC can be of two types: partially or totally external to the firm or internal. In the former are included aspects related to the characteristics of the external knowledge (Mowery et al., 1996; Lane and Lubatkin, 1998; Ahuja and Katila, 2001), the level of competitiveness or turbulence of the environment (Lev et al., 2009; Lichthentaler, 2009; Riemenschneider et al., 2010) and the characteristics of learning relationships (Lane and Lubatkin, 1998; Murovec and Prodan, 2009).

On the other hand, internal antecedents include elements related to employees, structures, policies, culture and business processes which affect the transfer, distribution, integration and creation of knowledge (Van den Bosch et al., 1999; Jansen et al. 2005). Examples are the cognitive models (Lane et al., 2006; Sun and Anderson, 2010), the management style (Kogut and Zander 1992; Schmidt, 2010) and the characteristics of firm´s structure (Van den Bosch et al. 1999).

In a recent review of the concept, Volberda et al. (2010) highlighted that managerial antecedents (which represent an internal determinant of AC) are among the most important for studies on AC and that more research on the relative effect of these management skills and capabilities on AC are needed. Examples of these managerial capabilities and skills include the structure of communication, human resource management mechanisms, the combinative capabilities, the character and distribution of expertise, gatekeeping or boundary-spanning roles, cross-functional interfaces, and job rotation (Volberda et al., 2010: 940).

Although it is widely accepted that absorptive capacity is a process that is inherently organizational (Cohen and Levinthal, 1990), few empirical studies have examined empirically how specific managerial antecedents

affect the learning processes behind a firm´s AC. The exceptions to this are the research of Pedersen and Schleimer (2012) and Jansen et al. (2005) that examined how different types of combinative capabilities (coordination capabilities, systems capabilities, socialization capabilities) affect differently the dimensions of a unit´s AC in a large financial services firm. Pedersen and Scheleimer (2012) extended the analysis of Jansen et al. (2005) and assessed how other internal antecedents such as innovative culture, decentralization and relationship strength influence dimensions of subsidiaries´ capacity to absorb knowledge from the headquarters.

Following the above studies, we also intend to take a closer look to the role of organizational mechanisms aimed at facilitating learning inside the firm and how they might have a different effect on the dimensions of a firm´s AC. The literature on organizational learning capability highlights four types of internal factors that facilitate learning inside the firm: experimentation, risk taking, dialogue and participation in decision-making (Alegre and Chiva, 2008).

Experimentation is defined as the degree to which new ideas and suggestions are attended to and dealt with sympathetically. It involves trying out new ideas, being curious about how things work, or carrying out changes in work processes (Nevis et al., 1995). It also includes the search for innovative solutions to problems based on the possible use of distinct methods and procedures. In organizations with an experimental mind-set, managers act like applied research scientists at the same time as they deliver goods and services (Leonard-Barton, 1992). These organizations constantly try new learning approaches and keep an open attitude toward new product development.

Risk taking can be understood as the tolerance of ambiguity, uncertainty, and errors. Hedberg (1981) suggested that designing environments where risk taking and accepting mistakes are assumed facilitates organizational

learning. Sitkin (1996) stated that acceptance of failure is a necessary element for effective organizational learning. In short, accepting or taking risk involves being tolerant of the possibility of mistakes and failures occurring.

Both of the above factors might encourage the development of entrepreneurial intuition of individuals inside the firm. In firms where experimentation and risk taking is promoted, employees are not restricted in seeking unfamiliar situations to access new and diverse experiences, and to violate the given beliefs and assumptions to come up with frame-breaking insights (Feist, 1999; Tierney et al. 1999). The above has been related to a firm´s capacity to acquire and assimilate information from external sources (Sun and Anderson, 2010) and to go beyond incremental innovation (Crossan et al. 1999). For instance, Kim et al. (2012) suggested that experimentation enables a firm to develop high-impact innovations as a result of its exploratory learning behavior. Hughes et al. (2007), considered experimentation and risk taking as two of the mechanisms that allow entrepreneurial firm´s to create knowledge through exploratory learning. Furthermore, it has been proposed that risk taking represents one of the common features of an entrepreneurial orientation that drives firm´s exploration processes and allows it to reconfigure resources and knowledge into new and better products (Atuahene-Gima and Ko, 2001; Bhuian et al., 2005).

Conversely, because promoting experimentation and risk taking mobilize firms to generate exploratory knowledge which is highly uncertain, erratic in its creation and of ex ante unknown value (March, 1991), it might reduce a firm´s exploitative learning. To facilitate the assimilation and application of external knowledge firms tend to acquire knowledge of a known value, which is already articulated and implies certain outcomes (Hite and Hesterly, 2001). This kind of knowledge requires less resources and time to be applied as a result of its relative certainty and known value

(Koza and Lewing, 1998). However, when the level of novelty and uncertainty present in the acquired knowledge is high, the ideas may not easily be assimilated to fit the old knowledge structures. Therefore, the cognitive structures of the individuals involved must adapt and be transformed to adapt to an idea or situation which they cannot incorporate in to the existing knowledge base of the firm (Todorova and Durisin, 2007). Futhermore, since exploitative learning is associated with refinement, efficiency and certainty, it sits uncomfortably next to the creativity and ambiguity implied by a behavioral focus on proactive discovery, change anticipation and tolerance to the unknown (Hughes et al., 2007).

Based in the above we propose:

H1: The more a firm promotes experimentation: a) the higher its level of exploratory learning, b) the lower its level of transformative learning, c) the lower its level of exploitative learning.

H2: The more a firm promotes risk taking: a) the higher its level of exploratory learning, b) the lower its level of transformative learning, c) the lower its level of exploitative learning.

Dialogue is described as a process of advocating and inquiring (Senge 1990). As group members become familiar with one another and develop values of honesty and trust, they become more comfortable in sharing sensitive information (Sun and Anderson, 2010). Schein (1993) considered dialogue as a basic process for building a common understanding in that it allows one to see the hidden meanings of words. In short, the literature understands dialogue to be vitally important for organizational learning (Brown and Duguid, 1991; Nevis et al., 1995; Dixon, 1997; Goh and Richards, 1997; Oswick et al., 2000). When a firm promotes dialogue, conflicting and diverging ideas can be handled positively, enriching the solution-finding process (Isaacs 1993). Furthermore group members'

cognitive maps are effectively revealed, and any radical insights are given a chance to come to verbal fruition, rather than being dominated by the prevailing beliefs and assumptions of the organization (Sun and Anderson, 2010). Dialogue has also proved to be successful as a sense-making instrument for creating a shared perception of reality (Mitki et al., 2007).

While external knowledge search takes place first at the individual level, the insight generated needs to be shared and interpreted by the group (Nonaka and Takeuchi, 1995). In this process, promoting dialogue might increase a firm´s ability to combine the newly acquired external knowledge with existing knowledge through facilitating "bisociation" among unit members (Zahra and George, 2002). This combination is essential for firm´s to retain and reactivate new knowledge (Kogut and zander, 1992; Lichtenthaler, 2009) and to convert the knowledge in to new products (Tsai, 2001). Based on the above we propose:

H3: The more a firm encourages dialogue: a) the higher its level of exploratory learning, b) the higher its level of transformative learning, c) the higher its level of exploitative learning.

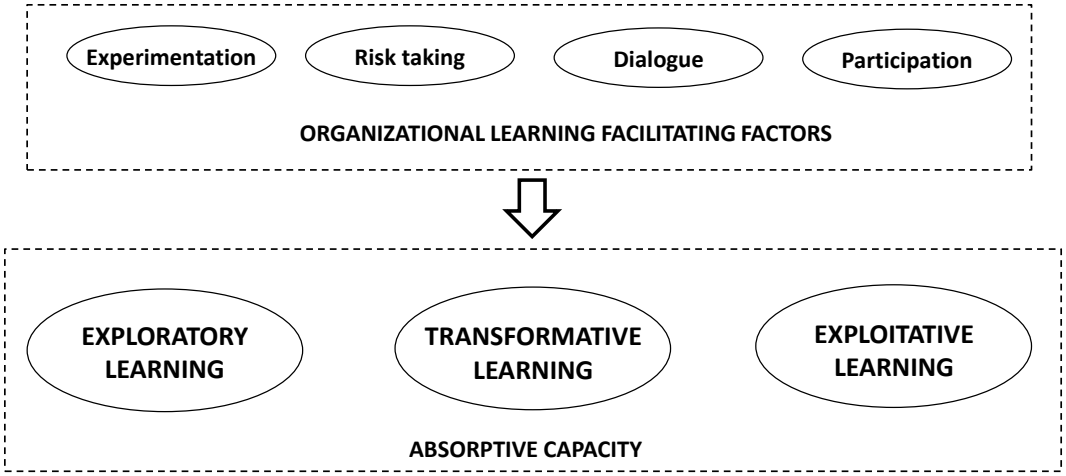
Finally, Participative decision-making refers to the level of influence that employees have in the decision-making process (Cotton et al., 1988). Organizations implement participative decision making to benefit from the motivational effects of increased employee involvement, job satisfaction and organizational commitment (Daniels and Bailey, 1999; Scott-Ladd and Chan, 2004). Studies in the organizational leaning (OL) and AC literature have established that Participatory decision-making positively influences both OL (Harvey and Denton 1999; Scott-Ladd and Chan 2004; Vera and Crossan 2004; López *et al.* 2006; Sun and Anderson, 2010) and the dimensions of AC (Jansen et al., 2005; Sun and Anderson, 2010). Participation increases the range of prospective "receptors" to the environment (Cohen and Levinthal, 1990) which in turn increases the

quantity and quality of new ideas and proposals while facilitating new external knowledge acquisition and assimilation (Aldrich and Herker, 1977; Sheremata, 2000; Jansen et al., 2005). However, it may slow down transformation and exploitation of new external knowledge considerably since it may hamper information processing efficiency (Lin and Germain, 2003) or make it more difficult to gain consensus on new product developments (Atuahene-Gima, 2003). Therefore we propose:

H4: The more a firm promotes participation in decision making: a) the higher its level of exploratory learning, b) the lower its level of transformative learning, c) the lower its level of exploitative learning.

The following figure resumes the theoretical model that we are going to assesss.

Figure 3.1 Organizational learning facilitating factor as antecedents of absorptive capacity



3.3 METHODOLOGY

3.3.1 Data collection

The study focused on small, medium-sized and large industrial firms. Since some issues such as innovation processes and external learning might differ substantially from one industry to another, we decided to test our hypotheses in four kinds of industries in Spain: Biotechnology, ceramics, toys and footwear. The above may provide some generalization power to our findings and will allow for interesting comparisons among these four sectors.

The ceramic tile industry is largely globalized. Spain represents the second largest manufacturer and exporter in Europe and the third largest world exporter of tiles, surpassed only by China and Italy (IVEX, 2012). This global presence is based on superior technology and design (McDonald and Vertova, 2001; Chiva, 2004). Most of the firms in this sector are considered to be SMEs as they do not generally exceed an average of 250 workers and they tend to be geographically concentrated in industrial districts (Enright and Tenti, 1990; Chamber of Commerce of Valencia, 2004; IVEX, 2012).

Similar to the ceramic sector, the toy industry is mainly composed of SMEs, with small firms generating around 80% of the 5,000 jobs in this industry (ICEX, 2012). This sector is characterized by the production of products with high design, quality and educational value, coupled with affordable prices (AEFJ, 2012; Holmstrom, 2005).

In the Shoe industry, many of the significant innovations come from: monitoring market trends, using new materials, optimizing logistics and distribution systems, carrying out projects with related industries and activities, and incorporating advanced computer assisted design and manufacturing technologies (Tomas et al., 2000; Molina-Morales, 2008; FICE., 2011; Martínez et al., 2012). According to data published by the

National Statistics Institute (INE), most of the firms have less than 250 employees. Furthermore, many leather and footwear companies base their business model on innovation activities, obtaining 21% of their turnover from new or improved products. This percentage is over 8% higher than for production activities overall, and is slightly above that of the industrial sector in terms of business derived from new and improved products (FICE, 2010).

Finally, the Biotechnology industry comprises different fields such as pharmaceutical, chemical, agriculture, veterinary science, medicine and even waste disposal (Powell et al., 1996). In biotechnology, Spain is the 4th country in the European Union in scientific production only surpassed by the United Kingdom, Germany and France and is growing four times above the average of the rest of the countries of the European Union. While the size of the biotechnology sector in Spain is still small compared to other markets, its average growth of 15% annually, is three times higher than that of Germany (the second fastest growing) and five times higher than the U.S (IVEX, 2012). Similar to the aforementioned sectors, the structure of the biotechnology sector is also characterized by a predominance of companies with under 250 employees. However, since it represents a technology intensive sector, its domestic expenditure on R & D is higher. This indicator has experienced an increase of 11.2% in the last years (ASEBIO, 2011).

Fieldwork was carried out from November 2011 to May 2012. The head of the R&D or similar was identified as the informant for the three learning processes and the organizational learning facilitating factors. In order to assure that the questionnaire items were fully understandable in the context of the sectors analyzed, a pre-test was carried out in 16 firms where four experts of each sector were interviewed.

Basically, the interviews reflected the insights from the literature and the informants were highly knowledgeable about the questions asked for this study. Therefore, the framework and questions that were derived from the literature analysis were used to conduct surveys in these sectors. In order to reach a representative sample of firms from each sector we contacted all those firms established in Spain by email to ask their participation in the study. A total of 474 firms agreed to participate in the study so we proceed to do personal interview with each of them. We obtained a total of 467 (out of 474) completed questionnaires, 104 from Biotechnology, 107 from ceramic, 150 from footwear and 106 from Toy firms. The sample obtained represents around 11% of the population belonging to the footwear sector (FICE, 2011), 17% of the biotechnology sector (ASEBIO, 2011), 12 % of the ceramic sector (IVEX, 2012) and 48% to the Toy sector of Spain. Both, the number of responses and the response rate can be considered satisfactory (Spector, 1992; Williams et al., 2004).

3.3.2 Measurements of variables

Organizational learning facilitating factors

To measure organizational learning facilitating factors we used an adapted version of the measurement instrument developed by Chiva et al. (2007) which captured the essential mechanisms that enable an organization to learn. These dimensions are *experimentation*, *risk taking*, *dialogue* and *participative decision making*. *Experimentation* consists of two items, which evaluate the extent to which firms support and encourage employees to generate new ideas (Isaksen et al., 1999). *Risk taking* comprises two items capturing whether firms allow people to venture in an unknown field to search for new ideas (Amabile et al., 1996; Isaksen et al., 1999). *Dialogue* consists of four items, which evaluate how firms promote interaction and communication between employees in order to facilitate internal knowledge transfer. Finally, *participation in decision-making* is formed by three items that capture the extent to which firms

involve employees in important decisions (Goh and Richards, 1997; Pedler et al., 1997). All the above measurement scales were applied using an 8-point Likert scale, where 1 represented total disagreement and 8, total agreement.

Absorptive capacity

We employed the scales designed by Lichtenthaler (2009) to measure a firm´s AC. This measure considers AC as a dynamic capability that results from thee complementary learning process named: explorative, transformative and exploitative learning processes. Exploratory learning is formed by the processes of *recognizing* and *assimilating* external knowledge. Recognition is measured with five-items and addresses firm's activities aimed at scanning the enviroment and monitoring industry information and external knowledge sources (Szulanski, 1996; Jansen et al., 2005; Arbussà and Coenders, 2007). On the other hand, assimilating is measured with a four-item scale and captures the activities aimed at absorbing knowledge from external sources (Szulanski, 1996; Jansen et al., 2005; Arbussà and Coenders, 2007).

Transformative learning comprises the activities of maintaining and reactivating knowledge. A four items scale was included to measure *maintainance* and capture firm´s activities aimed at retaining and storing knowledge, and the way it is shared and communicated internally (Marsh and Stock, 2006; Jansen et al., 2005; Smith et al., 2005). On the other hand, the four items measuring *reactivation* captures whether a firm can quickly react to opportunities by relying on its existing knowledge and firm's proficiency in addressing environmental changes by internalizing existing knowledge through experience (Marsh and Stock, 2006; Jansen et al., 2005; Garud and Nayyar, 1994).

Finally, exploitative learning is formed by the activities of *transmuting* and *applying* knowledge. Transmute is measured with a four item scale and

address firm's proficiency in combining new and existing knowledge. Finally, *application* is measured with a four item scale and capture firm´s activities aimed at implementing technologies in new products. All the measurement scales were consisted on 8-point Likert scale, where 1 represented total disagreement and 8, total agreement. (See table 3.6).

Control variables

Firm´s size and the industry were included as control varibles in the study. According to previous studies firm´s size may influence firm's willingness in developing AC, therefore we included the *natural logarithm* of the number of full-time employees within organizations (Veugelers, 1997; Jansen et al., 2005). Concerning the latter, previous studies have shown that knowledge strategies differ between industries (e.g. Lichtenthaler, 2007; Chen et al., 2011). Since our study includes four sectors (ceramic, biotechnology, shoe and toy) we included a dummy variable for the first three (1 "pertaining to this industry"; 0 "no pertaining to this industry) (Veugelers, 1997; Licthenthaler, 2007) to account for any sector effect.

3.4 ANALYSIS AND RESULTS

3.4.1 Psychometric properties of measurement scales

The psychometric properties of the measurement scales were evaluated using four criterions: content validity, reliability, discriminant validity, convergent validity and scale dimensionality (Gerbing and Anderson, 1988; Gatignon et al., 2002; Tippins and Sohi, 2003; Alegre and Chiva, 2008).

Content validity: It was established through a review of existing literature and through personal interviews with the managers of the firms analyzed. These interviews confirmed that all the items of the questionnaire were fully understandable in the context of the sectors analyzed.

Realiability: The reliability of a construct assesses the level of consistency with which the observable variables measure the latent variable (Fornell and Larcker, 1981). Previous studies employed the Cronbach´s alpha to evaluate this internal consistency, however it has been observed that high levels of this indicators does not guarantee that all the values obtained in the items are derived from the existence of a single latent variable (DeVellis, 1991). Therefore, the composite reliability and the average variance extracted (AVE) represents more appropriate measures (Werts et al., 1974).

Table 3.1 includes values of the composite reliability and the AVE for each of the constructs analyzed. The Cronbach's alpha coefficient is indicated in Table 3.2. As it can be observed, the value obtained in all the items loading and the composite reliability of the factors analyzed were over the minimum recommended of 0.7 (Nunnally, 1978; Hair et al., 1998; Iglesias, 2004). Furthermore, the AVE indices of each construct exceed the minimum standard of 0.5 (Hair et al., 1998).

Table 3.1 Composite reliability and variance extracted of organizational learning facilitating factors and learning processes

	Composite Reliability (CR) (0.70<*p* <1)	Variance extracted (AVE) (0.50<*p* <1)
OL faciliating factors		
Experimentation	0,91	0,83
Risk Taking	0,75	0,61
Dialogue	0,89	0,67
P. Decision Making	0,90	0,75
Learning processes		
Rec	0,88	0,59
Ass	0,87	0,62
Maint	0,86	0,60
React	0,84	0,57
Transm	0,86	0,61
Apply	0,87	0,62

Table 3.2 Factor correlations, means, standard deviations, and Cronbach's alphas

	Mean	s.d.	1	2	3	4	5	6	7	8	9	10
1. Exper	5.77	1.71	(0.91)									
2. Risk	5.21	1.88	0.59**	(0.74)								
3. Dia	6.42	1.34	0.54**	0.39**	(0.88)							
4. Part	4.91	1.86	0.56**	0.50**	0.49**	(0.90)						
5. Exp	5.43	1.47	0.48**	0.50**	0.38**	0.43**	(0.80)					
6. Trans	6.12	1.16	0.45**	0.37**	0.60**	0.30**	0.55**	(0.76)				
7. Expl	5.92	1.22	0.54**	0.50**	0.57**	0.46**	0.72**	0.76**	(0.82)			
8. Ln Empl[1]	2,74	1,38	-0,00	0,03	-0,012	0,04	0,28**	0,03	0,12**			
9. Ceramic	0,23	0,42	0,08	-0,05	-0,06	0,00	0,00	-0,07	-0,06	0,28**		
10. Footwear	0,32	0,47	-0,20**	-0,12*	-0,05	-0,27**	-0,19**	-0,00	-0,08	-0,11*	-0,38**	
11. Biotech	0,22	0,42	0,18**	0,27**	0,14**	0,24**	0,31**	0,12*	0,22**	-0,01	-0,29**	-0,37**

Note: n = 467. **Statistically significant correlation at p < 0.01. *Statistically significant correlation at p < 0.05. Cronbach's alphas are shown on the diagonal. [1] Logarithm of the number of full-time employees

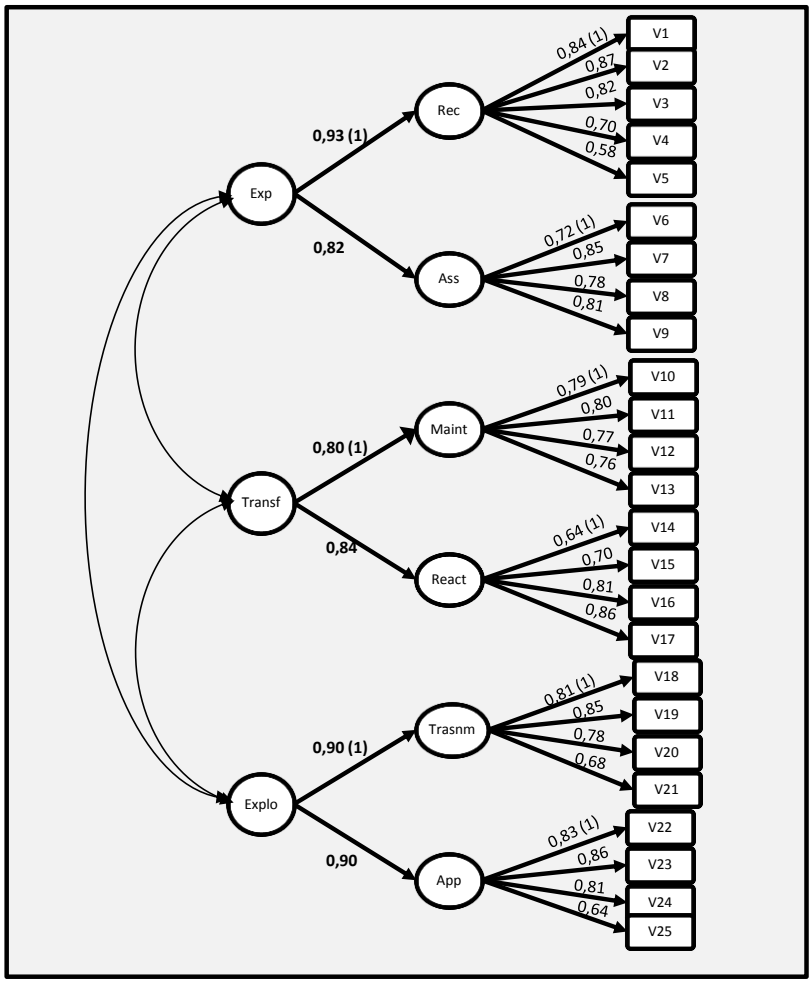
Constructs' dimensionality: It was evaluated through the loadings of the measurement items on their respective factors. All the standardized factor loadings (See Figure 3.1 and 3.2) are significant (p<0.001) and above the recommended minimum 0.40 (Ford et al., 1986).

Discriminant validity: This index indicates the level to with a construct is different from others constructs (Henseler et al., 2009). This analysis was performed by comparing the X^2 differences between a constrained confirmatory factor model with an inter-factor correlation set to 1 (indicating they are the same construct) and an unconstrained model with an inter-factor correlation set free. As it can be observed in Tables 3.3 and 3.4 the X^2 differences obtained in each on the cases were found to be significant providing evidence of discriminant validity for the measurement scales (Anderson and Gerbing, 1988; Gatignon et al., 2002; Tippins and Sohi, 2003).

Convergent validity: This criterion ensures that a set of indicators represents one and the same underlying construct which is demonstrated through their unidimensionality (Fornell and Larcker, 1981), This was confirmed

by comparing the X^2 differences between a constrained confirmatory factor model with an inter-factor correlation set to 0 (indicating that there is no relationship between the two constructs) and an unconstrained model with an inter-factor correlation set free. Tables 3.3 and 4 show that the X^2 differences are all significant which provides evidence of convergent validity for the measurement scales.

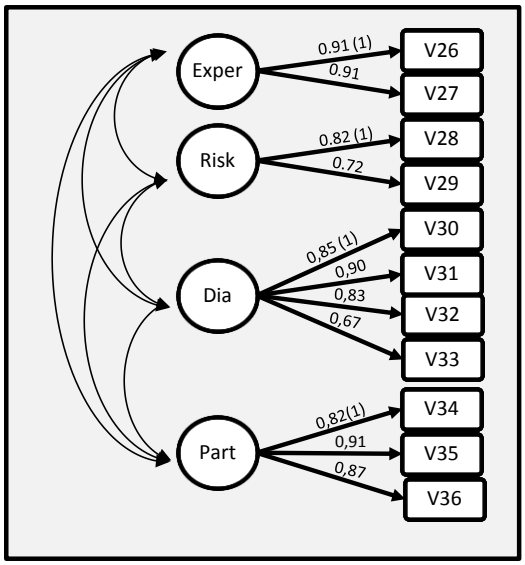
Figure 3.2 Confirmatory factor analysis of learning processes



X2=681.02 (p=0.000); d.f.=266;
NFI=0.87; NNFI=0.90; CFI=0.91;
RMSEA=0.06

Note: (1) The parameter was equaled to 1 to fix the latent variable scale. Parameter estimates are standardized. All parameter estimates are significant at a 95% confidence level (t≥1.96).

Figure 3.3 Confirmatory factor analysis of organizational learning facilitating factors



X2=180.21 (p=0.000); d.f.=67;
NFI=0.94; NNFI=0.95;
CFI=0.96;RMSEA=0.06

Note: (1) The parameter was equaled to 1 to fix the latent variable scale. Parameter estimates are standardized. All parameter estimates are significant at a 95% confidence level (t≥1.96).

Table 3.3 Pairwise confirmatory analyses for organizational learning processes: estimates of correlations

	Recognize					Assimilate					Maintain					Reactivate					Transmute				
	Φ	d.f	X^2	ΔX^2	p	Φ	d.f	X^2	ΔX^2	p	Φ	d.f	X^2	ΔX^2	p	Φ	d.f	X^2	ΔX^2	p	Φ	d.f	X^2	ΔX^2	p
Ass	0,76	26	73,38		0,00																				
	1	29	251,13	177,75	0,00																				
	0	29	285,53	212,15	0,00																				
Maint	0,56	26	75,00		0,00	0,52	19	53,47		0,00															
	1	29	367,97	292,97	0,00	1	22	422,22	368,75	0,00															
	0	29	152,81	77,81	0,00	0	20	116,60	63,13	0,00															
React	0,53	26	98,54			0,41	19	84,04			0,67	19	80,55		0,00										
	1	29	412,96	314,42	0,00	1	22	520,03	435,99	0,00	1	22	205,96	125,41	0,00										
	0	27	183,33	84,79	0,00	0	20	133,95	49,91	0,00	0	20	197,09	116,54	0,00										
Transm	0,64	26	74,81			0,54	19	53,09		0,00	0,70	19	67,73		0,00	0,84	19	59,05		0,00					
	1	29	314,82	240,01	0,00	1	22	443,25	390,16	0,00	1	22	209,6	141,87	0,00	1	22	125,30	66,25	0,00					
	0	27	201,71	126,90	0,00	0	20	143,19	90,10	0,00	0	20	194,54	126,81	0,00	0	20	328,96	269,91	0,00					
Apply	0,79	26	68,09		0,00	0,76	19	49,14		0,00	0,66	19	69,3		0,00	0,61	19	95,11		0,00	0,77	19	62,99		0,00
	1	29	219,13	151,04	0,00	1	22	892,23	843,09	0,00	1	22	260,85	191,55	0,00	1	22	287,8	192,69	0,00	1	22	172,48	109,49	0,00
	0	27	281,86	213,77	0,00	0	20	250,08	200,94	0,00	0	20	178,85	109,55	0,00	0	20	205,55	110,44	0,00	0	20	250,25	187,26	0,00

Table 3.4 Pairwise confirmatory analyses for organizational learning facilitating factors: estimates of correlations

	Experimentation					Risk taking					Dialogue				
	Φ	**d.f**	**X^2**	**Δ X^2**	**p**	**Φ**	**d.f**	**X^2**	**Δ X^2**	**p**	**Φ**	**d.f**	**X^2**	**Δ X^2**	**p**
Risk	0,72	1	0,68		0,41										
	1	4	82,23	81,55	0,00										
	0	3	122,26	121,58	0,00										
Dia	0,56	8	24,23		0,00	0,44	8	30,02		0,00					
	1	11	225,05	200,83	0,00	1	15	808,69	778,67	0,00					
	0	9	114,49	90,26	0,00	0	9	73,00	42,98	0,00					
Part	0,61	4	6,05		0,20	0,61	4	8,15		0,09	0,47	13	86,76		0,00
	1	7	273,96	267,90	0,00	1	7	129,53	121,38	0,00	1	16	563,90	477,13	0,00
	0	5	107,20	101,15	0,00	0	5	95,41	87,26	0,00	0	9	203,60	116,84	0,00

Since the measures of the AC and of the organizational learning facilitating factors were collected from the same informant, we assessed the extent of common method variance by conducting a Harman's single-factor test (Podsakoff and Organ 1986; Podsakoff et al. 2003). The results of the confirmatory factor analysis with all the indicators loading into a single-factor ($\chi2$=4085.60; d.f.=702; NFI= 0.575; BBNFI=0.597; CFI=0.619; RMSEA=0.102; $\chi2$/d.f.=5.82) showed a poor fit. The above highlights that a single-factor possibility is not relevant (Bou-Llusar et al. 2008).

3.4.2 Results of the regression analysis

The correlations between the variables included in the empirical analysis and the descriptive statistics are listed in Table 3.2 We calculated variance inflation factors (VIFs) to evaluate the issue of multicollinearity. The maximum VIF within the models was 2.07, which was well below the rule-of-thumb cut-off of 10 (Neter et al., 1990).

Table 3.5 represents the results of the hierarchical regression analyses for the organizational learning facilitating factors on the different learning processes. Un-standardized coefficients, with standard errors in parenthesis are reported. Model 1 corresponds to exploratory learning. As expected, the organizational learning facilitating factors associated with experimentation ($p < 0.001$), risk taking ($p < 0.001$), dialogue ($p < 0.05$) and participation in decision making ($p < 0.05$) presented a positive and significant effect on exploratory learning. The above give support to hypothesis 1a, 2a, 3a and 4a.

Model 2 corresponds to the results of the effect of the organizational learning facilitating factors on transformative learning. Experimentation ($p< 0.001$) and risk taking (0.05) had not negative effect on transformative learning. Contrary to our prediction, experimentation and risk taking even increased transformational learning. Hypothesis 1b and 2b were not supported. On the other hand, dialogue ($p< 0.001$) had a highly significant

positive effect on transformative learning. Hypothesis 3b was supported. The coefficient for participation in decision making was both negative and significant for firm´s ability to maintain and reactivate external knowledge. Hypothesis 4b was confirmed.

Finally, Model 3 introduced the effect of each of the organizational learning facilitating factors on exploitative learning. Contrary to our expectations, the results showed that experimentation and risk taking also had a positive and significant effect on exploitative learning. Hypothesis 1c and 2c were not confirmed. In accordance with hypothesis 3a, the coefficient for dialogue was positive and significant which means that it contributed to increase firms´ exploitative learning processes. The coefficient for participation in decision making was positive but not significant. Hypothesis 4c was not supported.

Table 3.5 Results of hierarchical regression analyses

Variables	Exploratory Learning	Transformative Learning	Exploitative Learning
	Model 1	Model 2	Model 3
OL facilitating factors			
Exper	0,178***	0,109**	0,139***
	(0,044)	(0,035)	(0,035)
Risk	0,184***	0,074*	0,122***
	(0,036)	(0,029)	(0,029)
Dialog	0,117*	0,438***	0,308***
	(0,048)	(0,039)	(0,039)
Part	0,074*	-0,058*	0,056+
	(0,037)	(0,030)	(0,030)
Control variables			
Ln Employess	0,293***	0,043	0,120***
	(0,040)	(0,032)	(0,032)
Ceramic	-0,110	-0,108	-0,136
	(0,161)	(0,130)	(0,129)
Footwear	-0,047	0,105	0,102
	(0,147)	(0,118)	(0,118)
Biotech	0,557***	0,034	0,198
	(0,160)	(0,129)	(0,128)
R-square	0.425***	0.399*	0,461***

Note: +p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001

3.5. DISCUSSIONS AND CONCLUSIONS

The purpose of this study has been to examine the different effects of organizational learning facilitating factors and external knowledge search strategies on firm´s exploratory, transformative and exploitative learning processes. Although very important advances have been made in the analysis of the antecedents of absorptive capacity (e.g. Jansen et al., 2005; Pedersen and Schleimer, 2012), the link between specific managerial mechanisms and the learning processes that generate a firm's AC have not been fully analyzed. Based on the empirical results, we conclude that organizational mechanisms aimed at facilitating external learning affect firm´s exploratory, transformative and exploitative learning processes in different ways. Our findings deepen the understanding provided by previous studies (e.g. Jansen et al., 2005) and shows how the firms´ ability to manage different learning processes follows different developmental paths.

The Results also indicate that promoting experimentation and risk taking primarily enhance exploratory learning processes. However, contrary to our expectations, experimentation also has a positive significant effect on the transformative learning process. Moreover, risk taking does not decrease a firm's capacity to transform external knowledge and both facilitating factors highly improve exploitative learning processes. A possible explanation for these results relates to the existing knowledge base of a firm. Recent studies have suggested that the more technological and market knowledge a firm has, the easier it is for it to maintain and reactivate additional knowledge (Garud and Nayyar, 1994; Lichtenthaler, 2009). According to industry reports of the sectors analyzed, most firms base their business model on innovation activities so a high percentage of their turnover comes from new or improved products (Tomas et al., 2000; Chiva, 2004; FICE, 2011; ASBEIO, 2011). The above could be an indication that these firms continuously invest in renovating the existing knowledge

base. Therefore, the level of novelty and uncertainty present in the knowledge incorporated by promoting experimentation and risk taking may be low, since firms already have considerable technological and market knowledge which allows them to efficiently manage the retention and application of new external knowledge. Futures studies could incorporate measures of the existing knowledge base to assess its role in the above relationships and how the types of collaborations firms sustain with external sources facilitate this process.

Our findings reveal that promoting dialogue inside the firm contributes towards enhancing exploratory, transformative and exploitative learning as we predicted. To some degree, this pattern bears similarities to others recent studies suggesting that dense connections between a firm and other external organizations may promote two-way learning, which helps to improve the assimilation, transformation and exploitation of new external knowledge (Jansen et al., 2005; Sun and Anderson, 2010).

The facilitating factors associated with participation in decision-making provide somewhat surprising results. Promoting participation in decision-making positively contributes to exploratory learning and at the same time decreases a firm´s transformative learning process as we predicted. However, it does not decrease a firm's exploitative learning process. Rather it seems to presents a low positive effect on exploitative learning. A possible explanation could be the type of leadership present at the organization and how they distribute the power at different levels of the organization. Before implementing an idea, transformational leaders tend to stresses the overall vision and goal of the organization (Sun and Anderson, 2011). By doing so, they encourage the necessary cooperation of the different functions so that new ideas could be assessed and clarified before its application (Kahai et al., 2003). This aspect has been argued to be essential for transmuting the new idea (Todorova and Durisin, 2007; Lichtenthaler, 2009) and to minimize the resistance to its implementation

(Sun and Anderson, 2011). Futures studies could incorporate in the analyses the type of leadership present at the top and middle manager and how this could moderate the influence of participation in decision making on exploitative learning.

Important contributions have been made about the conceptual affinity and connection between the literature of OL and AC, about their nomological nets and the similarity of antecedents. However, few studies have analyzed empirically these connections (Sun and Anderson, 2010). Our study contributes to this line of studies by examining empirically how different internal facilitating factors are also essential in increasing firms´ capability to assimilate, transform and apply new knowledge. Furthermore, it advances understanding provided by previous studies about combinative capabilities (Eisenhardt and Martin, 2000; Jansen et al., 2005) and shows that firms may use different combination of facilitating factor depending of the learning process they need to improve. More specifically, our study shows that promoting dialogue is essential not only in generating transformative and exploitative learning but also in enhancing firms´ exploratory learning processes.

The above finding contrasts with previous studies that suggested that promoting connectedness and socialization tactics between unit members may constraint individuals from performing broad searches for a variety of knowledge sources and also create collective blindness (Janis, 1982; Nahapiet and Goshal, 1998). In the context of AC, the danger of organizational inertia is limited (Leonard-Barton, 1992). In exploratory learning, the knowledge acquired from external sources by firm´s member need to be translated to the organizational context (Sun and Anderson, 2010). In this process, the level of trust and familiarity between group members is essential since it allows people to feel more comfortable about sharing sensitive information and to arrive to a shared understanding of what has been intuited (Nonaka and Takeuchi, 1995). Therefore, not

promoting connections between members, when exploring the environment, may be counterproductive for the firm.

Some limitations of the study should be highlight, as these may open new lines of research. First of all, the data consisted in a self-reported assessment of a single informant. Therefore the issue of informant bias and common method bias cannot be totally ruled out. However, the confidentiality that was assured for respondents together with the good indices of reliability and the Harman´s one-factor analysis provided evidence against the presence of one common factor (Jansen et al., 2005). Secondly, our model analyses only include some internal antecedents of a firm´s AC. Other factors and aspects merit further study such as the type of leaderships, the human resources practices, the power and the role of individuals and their interaction at the different levels of the firm (Easterby-Smith et al., 2008; Volberda et al., 2010; Sun and Anderson, 2011). Furthermore, our data is cross sectional which allows us to analyze only a specific situation in time of the organizations studied, not their overall conduct overtime. Futures studies should focus on longitudinal study to evaluate how the contribution of the organizational learning facilitating factors to firm´s learning process may change according to the evolution of firm environment and what external aspect may affect that relation.

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Appendixes:

Table 3.6 Questionnaire items

A) Absorptive Capacity

Could you please indicate your level of agreement with the following statements about your organization?		
Dimensions	Item	Literature source
Recognize	x1: We frequently scan the environment for new technologies.	Arbussà and Coenders, (2007); Jansen et al., (2005); Szulanski, (1996); Lichtenthaler, (2009)
	x2: We thoroughly observe technological trends.	
	x3: We observe in detail external sources of new technologies.	
	x4: We thoroughly collect industry information.	
	x5: We have information on the state-of-the-art of external	
Assimilate	x6: We frequently acquire technologies from external sources	
	x7: We periodically organize special meetings with external partners to acquire new technologies.	
	x8: Employees regularly approach external institutions to acquire technological knowledge.	
	x9: We often transfer technological knowledge to our firm in response to technology acquisition opportunities.	
Maintain	x10: We thoroughly maintain relevant knowledge over time.	Jansen et al., (2005); Marsh and Stock, (2006); Smith et al., (2005); Lichtenthaler, (2009)
	x11: Employees store technological knowledge for future reference.	
	x12: We communicate relevant knowledge across the units of our firm.	
	x13: Knowledge management is functioning well in our company..	
Reactivate	x14: When recognizing a business opportunity, we can quickly rely on our existing knowledge.	Garud & Nayyar, (1994); Jansen et al., (2005); Marsh and Stock, (2006); Lichtenthaler, (2009)
	x15: We are proficient in reactivating existing knowledge for new uses..	
	x16: We quickly analyze and interpret changing market demands for our technologies.	
	x17: New opportunities to serve our customers with existing technologies are quickly understood.	
Transmute	x18: We are proficient in transforming technological knowledge into new products.	Jansen et al., (2005); Smith et al., (2005); Todorova and Durisin, (2007); Lichtenthaler, (2009)
	x19: We regularly match new technologies with ideas for new products.	
	x20: We quickly recognize the usefulness of new technological knowledge for existing knowledge.	
	x21: Our employees are capable of sharing their expertise to develop new products.	
Apply	x22: We regularly apply technologies in new products.	Jansen et al., (2005); Smith et al., (2005); Szulanski, (1996); Lichtenthaler, (2009)
	x23: We constantly consider how to better exploit technologies.	
	x24: We easily implement technologies in new products.	
	x25: It is well known who can best exploit new technologies inside our firm.	

B) Organizational learning facilitating factors items

Could you please indicate your level of agreement with the following items about your organization?		
Dimensions	Item	Literature source
Experimentation	X26: People here receive support and encouragement when presenting new ideas.	Isaksen et al. (1999)
	X27. Initiative often receives a favorable response here, so people feel encouraged to generate new ideas.	
Risk taking	X28: People are encouraged to take risks in this organization.	Amabile et al. (1996); Isaksen et al. (1999)
	X29: People here often venture into unknown territory.	
Dialogue	X30: Employees are encouraged to communicate.	Templeton et al. (2002); Amabile et al. (1996); Pedler et al. (1997); Hult and Ferrell (1997)
	X31: There is a free and open communication within my work group.	
	X32: Managers facilitate communication.	
	X33: Cross-functional teamwork is a common practice here.	
Participation in decision making	X34: Managers in this organization frequently involve employees in important decisions	Goh and Richards (1997); Pedler et al. (1997)
	X35. Policies are significantly influenced by the employees' views,	
	X36. People feel involved in main company decisions	

Capítulo 4:

The Role of Openness in Explaining Firms´Absorptive Capacity

ABSTRACT

The present study analyzes how different antecedents of a firm´s AC affect the dimensions of the concept. By analyzing a sample of 467 firms from Spain, results reveal that openness of external knowledge search contributes to firms' exploratory, transformative and exploitative learning processes in different ways. Particularly, we found a strongly positive effect of the breadth of external knowledge search on exploratory learning and that this type of learning is a curvilinear function of the number of relationships a firm has with different types of external agents. However, in order to develop exploitative learning it is more important for a firm to establish deep relations with external agents.

4.1. INTRODUCTION

Absorptive capacity (AC) represents one of the most important constructs that has emerged in research on organization theory in recent decades (Lane et al., 2006). This concept was introduced by Cohen and Levinthal (1989) and since its publication; it has been analyzed in different fields and contexts. Existing organizational research provides many interesting insights into absorptive capacity, however, contributions to and extensions of the original concept have often been theoretical with relatively less empirical validation (Volberda et al., 2010; Pedersen and Schleimer, 2012).

In the literature various elements have been highlighted as antecedents of firms' AC. However, external antecedents represent one of the most common analyzed (lane et al., 2006). This type of antecedent refers to characteristics of external knowledge sources, cooperation initiatives or external knowledge search strategies, which determine a firm's ability to identify, and assimilate external knowledge (Szulanski 1996, Mowery et al., 1996, Lane and Lubatkin, 1998; Lane et al., 2006; Khamseh and Jolly 2008). While the effects of inter-organizational relationships (Murovec and Prodan, 2009) have been explored in the empirical literature, the ways they contribute to the organizational learning processes associated with firms´ AC have not been fully analyzed.

Recent studies on the process based definition of AC suggest that more studies are necessary to understand how absorptive capacity is generated and how collaboration with technological and market knowledge sources may contribute to the dimensions of the concepts (Lichtanthaler, 2009:

842). Examining the aforementioned would not only clarify how absorptive capacity can be developed, but also reveal why firms have difficulties in managing the learning processes behind a firm's successful use of external knowledge (Sun and Anderson, 2010).

Therefore, with the present study we aim to address these issues and to contribute to existing literature in several ways. Based on the process base definition of AC (Lane et al., 2006), we assess the impact of different external knowledge search strategies on dimensions of a firm´s AC. Although recent theoretical (e.g. Easterby-Smith et al., 2008; Sun and Anderson, 2010) and empirical studies (e.g. Jansen et al., 2005; Fabrizio, 2009; Murovec and Prodan, 2009) have paid increasing attention to inter-organizational antecedents, the role of external knowledge search strategy as a potentially important antecedent of a firm´s explorative, transformative and exploitative learning processes has been little explored.

According to Teece (1989), no company possesses all the technological resources needed to innovate internally. Rather, firms need to establish external connections to access knowledge located outside their boundaries or to find sources of variety that facilitate the creation and combination of new technologies and knowledge (Nelson and Winter, 1982; Laursen and Salter 2006). These external connections could consist in developing depth or breadth relations with specific kinds of agents (Laursen and Salter, 2006). Also, firms´ knowledge needs may orientate the external search to specific kinds of external actors (Chen et al., 2011).

Despite the importance of the aforementioned elements, existing studies have only focused on co-operation with certain types of actors (Cockburn and Herderson, 1998; Vinding, 2006; Fabrizio, 2009; Lee et al., 2010) and have investigated the influence of cooperation on absorptive capacity in general terms and not on the different learning dimensions underpinning

the concept (e.g. Murovec and Prodan, 2009). Since the managerial challenges posed by the aforementioned learning processes differ, distinct components of prior knowledge may be critical in the development of AC at the organizational level (March, 1991; Garud and Nayyar, 1994; Jansen et al., 2005; Lichtenthaler, 2009). Therefore, analyzing the effect of different external knowledge search strategies on learning processes may help us to understand why some firms are able to take advantage of the knowledge coming from external sources and others not. The above would help to open the black box of inter-organizational antecedents of AC by showing empirically the relative importance of specific types of external knowledge search strategies in generating a firm's capability to explore, transform and exploit external knowledge.

The structure of this paper is as follows. In section 4.2, we provide a literature review and propose three research hypotheses. In section 4.3, the methodology used in the empirical study and the characteristics of the sample data are described. In section 4.4, the results obtained are described. Finally in section 4.5 the conclusions and implications are discussed.

4.2 LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

4.2.1 External knowledge search strategies

Since no company possesses all technological resources internally (Teece, 1986), firms need to develop external links to access knowledge located out of their boundaries or to find sources of variety that facilitate the creation and combination of new technologies and knowledge (Nelson and Winter, 1982; Laursen and Salter 2006).

Previous studies have found that scanning and tracking external knowledge, and obtaining advanced technology from partners to cover gaps in technological knowledge are positively related to the innovative performance of the firm (Brown and Eisenhardt, 1995; George et al., 2001;

Rothaermel and Alexandre, 2009). For instance, Brown and Eisenhardt (1995) found that firms relying on external technology sourcing to probe and access cutting-edge knowledge, held beyond the boundaries of the focal firm, were more successful in introducing new products than firms focusing on internal technology sourcing. George et al., (2001) highlighted the differential effect of alliance portfolio characteristics, such as structure and flow, on firm performance and the importance for future researchers to study its effect in different industries and organizational groups. Rothaermel and Alexandre (2009) found an inverted U-Shaped relationship between a firm's technology sourcing mix and a firm's performance, which in turn implies that pursuing ambidexterity in technology sourcing enhances firm performance. Fabrizio (2009) found that investing in internal basic research and collaboration with university scientists provide search benefits in terms of both the pace of innovation and the importance of the resulting inventions. All the above studies highlight the importance of collaborating with external agents for identifying new opportunities to innovate and obtaining a higher performance than competitors.

Since search strategies are rooted in past experiences and future expectations of managers, it is difficult for many organizations to determine the 'optimal' search strategy in terms of being 'broader and/or deeper', especially in situations where there is turbulence in the knowledge base of the firm (Levinthal and March, 1993: 103). The breadth of the search refers to the number of external sources or search channels that firms rely upon in their innovative activities, whereas the depth represents the extent to which firms draw deeply from different external sources or search channels (Laursen and Salter, 2006: 134). Organizations that invest in broader and deeper search may have a greater ability to adapt to change and therefore to innovate. However, the previous experience and expectations of managers may lead firms to over-search

the external environment, which might have negative consequences on the firm's innovative performance (Laursen and Salter, 2006: 135; Chen et al., 2011). Furthermore, establishing too many external relationships could increase search costs and the potential danger of leakage of key technologies, which may negatively affect innovation performance. Therefore, increasing the diversity of partners improves a firm´s innovative performance up to an optimal number of partners, after which openness becomes counterproductive (Chen et al., 2011: 365).

An additional aspect that further enriches the analysis of firm openness of external knowledge search is the orientation of external search. Since different types of partners have different technological skills and capabilities, it is important that innovating firms choose the right type of partners for the specific help they need (Rothaermel, 2001; Rothaermel and Deeds, 2004; Faems et al., 2005; Chen et al., 2011). Chen et al., (2009) found that external agents such as value chain partners, technology related organizations and universities and research labs represent effective external sources for improving firms´ innovative performance and that their relative importance depend on the type of innovation mode prevailing in firms´ industries. The above highlight that not only are the breadth and depth of external technology searches important; but also the type of partners with which an innovative firm co-operates (Chen et al., 2011: 365).

4.2.2 External collaboration and absorptive capacity

In the literature several elements have been identified as antecedents of a firm´s AC. Inter-organizational antecedents represent one the most analyzed (Lane et al., 2006). A possible explanation may be the direct focus of the absorptive capacity concept on acquiring knowledge, which represents one of the common reasons for a firm to establish collaboration with external actors (Lane et al., 2006). Previous studies assessing the link between AC and inter-organizational antecedents have focused primarily

on the characteristics of the previous or related knowledge (Lane and Lubatkin, 1998; Lane et al., 2006). However, the nature and the kind of knowledge required by one of the firms collaborating may also affect the knowledge transfer particularly through the type of mechanism required for transferring it (Khamseh and Jolly, 2008). Therefore, other aspects such as the nature of the relationship, the search mechanisms and the level of trust could influence the knowledge transfer and the development of AC (Khamseh and Jolly, 2008).

Recently, some research investigating the influence of an organization's collaboration with different external actors on absorptive capacity has been conducted (Murovec and Prodan, 2009). For instance, Fabrizio (2009) suggests that the degree of connectedness with university scientists allows firm researchers to identify and absorb external knowledge. Cockburn and Herdenson (1998) argue that in order to improve AC, pharmaceutical firms need to invest not only in basic research, but also it is important for them to be actively connected to the wider scientific community. Spithovent et al., (2010) demonstrate that collective research centers help to build absorptive capacity within their client firms by providing functions such as intelligence services (e.g. gatekeeping, technology watch) and knowledge agency and knowledge repository (e.g. technical libraries, study days, etc). However, to our knowledge, none of the previous studies (with the exception of Murovec and Prodan, 2009) have tried to analyze its effects on dimensions of a firm´s AC. Murovec and Prodan (2009) found that collaboration with different types of external agents, such as those located in the value chain or those from public or commercial sources, were positively related to the extent of demand-pull and science-push AC. The former refers to firms´ capacity to absorb market information (e.g. customers, suppliers, competitors, professional conferences, fairs) whereas the latter refers to the capacity to absorb scientific information (e.g. universities, non-profit research institutes,

commercial R&D enterprises). In their analysis they showed that innovative cooperation represents one of the main determinants of science push absorptive capacity for industries located both in Spain and Czech Republic. However, the effect on demand-pull AC was not significant in any of the above samples.

Despite the important contribution of Murovec and Prodan (2009), their analyses only captured the effect of the breadth of external knowledge search on AC and not on the learning processes that originate it. Furthermore, how other elements of external knowledge search, such as the depth and the orientation, affect the different dimensions of AC was not analyzed. Murovec and Prodan (2009) measure AC with the use and importance of different sources of information needed for suggesting new innovation projects or implementing existing projects. These measures were based on the assumption that in order for an organization to be able to use certain external sources of information for its innovation activity, it must possess certain absorptive capacity; so an organization that uses more different external sources and considers them to be of greater importance, possesses greater absorptive capacity (Murovec and Prodan, 2009: 864). However, the aforementioned measure represents only an approximation to the original concept since it only provides information about the external knowledge search behavior of the firm, rather than the learning processes that allow the firm to identify, assimilate and apply external knowledge in the products or services that it develops.

Depending on knowledge needs, firms may establish scanning mechanisms to facilitate the acquisition and application of external knowledge (Cohen and Levinthal, 1990; Elenkov, 1997). This mechanism could consist of developing breadth and depth relationships with external agents (Laursen and salter, 2006; Chen et al., 2011).

In the following section we will analyze the effect of the knowledge search strategies on each of the learning processes that generate a firm´s AC.

4.2.3 The role of depth and breadth on exploratory learning

In the process view of AC, exploratory learning comprises two stages: recognizing the value present in the external knowledge and assimilating this new knowledge in the context of the organization (Lichtenthale, 2009; Lane et al., 2006). For recognizing external knowledge a prior related technological and market knowledge base is necessary (Zahra and George, 2002; Lane et al., 2006). Previous knowledge base provides firms of the relevant problem-solving method that are critical for subsequent knowledge application (Larsson et al., 1998; Lane and Lubatkin, 1998). After the knowledge is recognized, firms need to establish the mechanisms that facilitate the continued acquisition and assimilation of the knowledge in the context of the firms (Lane et al., 2006; Zahra and George, 2002; Lichtenthaler, 2009). According to Sun and Anderson, the above process takes place both at the individual and group level (Sun and Anderson, 2010). At the individual level, employees though their own intuition acquire and assimilate external knowledge. However, this new knowledge needs to be translated to the context of the organization in which the influence of a group is essential (Kim 1998; Sun and Anderson, 2010).

Depending on the knowledge needs, a firm may establish scanning mechanisms to facilitate the identification of the knowledge present in the environment (Cohen and Levinthal, 1990). These mechanisms or strategies may consist in developing a wide or deep number of relations with external agents (Laursen and Salter, 2006). According to previous studies, developing relations with different external actors is positive related to explorative learning (Behrens and Krackardt, 2000; Ahuja and Lampert, 2001). The generation of news ideas often comes from interaction with partners located in different lines of business, since these companies facilitate the access to a different knowledge base (Granovetter, 1973; Dittrich and Duysters, 2007). Therefore, a firm pursuing to increase

knowledge base for product development will often establish collaboration with partners they infrequently partner with (Dittrich and Duysters, 2007). One of the characteristics of this search strategy is the development of weak ties with external agents which confer firms with the sufficient flexibility to try different external sources and to learn how to gain knowledge from them (Duysters and De Man, 2003; Laursen and Salter, 2006).

However, searching widely is not costless. Managers need to invest time and effort in creating an understanding of the different external knowledge channels because ex ante it is difficult for them to know which external knowledge source would be the most rewarding for the firm (Laursen and salter, 2006: 136). Since search strategies are based on past experience, previous unrewarding collaborations may limit the location and the attention played to using different external sources (Levinthal and March, 1993: 103). According to Laursen and Salter (2006) the aforementioned may lead managers to over-search external sources which at a certain point make external search breadth become disadvantageous for innovative performance.

Koput (1997) suggested that the negative effect of over-searching on innovative performance may be a consequence of a decrease of a firm´s AC. According to this author the positive feedback obtained from using external sources of knowledge brings further attention to the associated source. However, there is a limit to this effect, as any firm faces some finite capacity to allocate attention to search activities (Koput, 1997: 533). The above could imply that firms exceeding the limit of external sources to which they can allocate attention will present deficiencies in assimilating the new knowledge. For exploratory learning to occur, new coming knowledge needs to be translated to the context of the organization and connected with previous knowledge base (Sun and Anderson, 2010).

Therefore, over-searching may be detrimental for developing exploratory learning.

Considering the above, the following hypothesis is postulated:

Hypothesis 1a: An inverted U-shaped relationship exists between the breadth of external knowledge search and the exploratory learning process of a firm.

Another mechanism used by firms to identify new knowledge sources may consist in developing deep relations with a reduced number of external agents (Laursen and Salter, 2006). Besides the fact that strong ties with external actors have been mainly related to exploitative learning (Krackhardt, 1992; Dittrich and Duysters, 2007) it may also facilitate the assimilation of new valuable knowledge. For instance, Hansen (1999) shows that weak interunit ties allow project teams to identify useful knowledge present in other subunits. However, for transferring complex knowledge it is necessary to have strong ties between the two parties. In a similar vein Messeni-Petruzzelli et al. (2010) suggest the importance of strong inter-organizational ties as mechanisms that enable the transfer of knowledge in universities' network structures. Also when the knowledge firms required for their innovation is tacit, they may require close interaction with external actors to facilitate the transfer and combination of the knowledge with the already existing knowledge base (Chen et al, 2011).

However, similar to the case of broad relations, some firms may rely too much on external collaboration to develop explorative learning. Increasing the number of in-depth relations with external agents takes time and also requires resources (Laursen and Salter, 2006). Following our previous argument, we also suggest that firms relying on too many in-depth relationships with external agents will present lower explorative learning.

Hypothesis 1b: An inverted U-shaped relationship exists between the depth of external knowledge search and the exploratory learning process of a firm.

4.2.4 The role of depth and breadth on exploitative learning

Exploitative learning is associated with matching knowledge and market opportunities (Rothaermel and Deeds, 2004) by transmuting the assimilated knowledge and applying this knowledge to commercial ends (Lane et al., 2006; Licthenthaler, 2009). This learning process occurs where the actual implementation of the assimilated knowledge takes place so as to ensure its reuse (Lane et al., 2006; Sun and Anderson, 2010).

Studies in the literature on inter-organizational collaboration and networks highlight that exploitation requires intensive knowledge exchange. Strong ties are characterized by intimate, recurrent and trustful relationships (Karckardt, 1992). They facilitate the creation of a pattern of interaction and a shared understanding and common ways of working together between firms (Dyer and Sigh, 1998; Laursen and saltern, 2006).

Since the emphasis in exploitative learning is on incorporating the newly acquired and transformed knowledge into the operation and products (Zahra and George, 2002; Sun and Anderson, 2010) strong relations with an external actor may assist a firm in this process (Rowley et al., 2000). For instance, Dyer and Nobeoka (2000) report that in the Toyota supplier network, core groups of five to seven suppliers sharing common operations and working closely together to generate knowledge and experience on how to make cost reduction improvement were more able to exploit their core innovation as a result of the sharing routines. Rowley et al., (2000) suggest that strong relations produce thick information exchanges, trust and joint problem solving which allow firms to gain organizationally embedded know how and assist them in their exploitation process. Rothaermel and Deeds (2004) find that exploitation is connected with fewer partners, lesser knowledge diversity, and stronger

integration among the partners. Considering the above, it is rational to suggest that external knowledge search strategies based on developing depth relations with external agents are positive related to exploitative learning.

On the other hand, developing relations with a wide number of external actors will bring as a result relations characterized by a lower level of commitment than searching deeply (Burt, 1992). As argued in the previous section, this kind of search behavior suit better for exploring new knowledge sources since it gives firms the sufficient flexibility to try and learn how to get knowledge from different external sources (Laursen and Salter, 2006). Since exploitation is aimed at strengthening and broadening firm processes and knowledge (Dittrich and Duysters, 2007), connection with potential external actors need to be deeper to facilitate the incorporation of the newly acquired knowledge in the products or processes of the firms (Krackhardt, 1992; Hansen et al., 2001). Therefore, following the above we argue that developing relations with a wide number of external actors would not be enough for firms to develop exploitative learning. Rather, firms need to develop certain level of trust and the knowledge sharing routines to facilitate knowledge application (Lane and Lubatkin, 1998; Dittrich and Duysters, 2007).

Closer interaction and communication with users of products is a prerequisite for the experience-based learning that supports product innovation of firms (Jensen et al., 2007). However, increasing the intensity of the relations may bring problems of free riding and knowledge leakage which could reduce a firm's interest in opening their innovation processes through depth relations (Chen et al., 2011). Although the above could be more evident in collaboration with R&D focused industries, key technologies may also suffer leakage through common users and suppliers (Jensen et al., 2007). Furthermore, managing a high number of relations requires time and resources (Laursen and Saltern, 2006). Therefore, firms

increasing the scope of the relations with external actors will not be able to allocate the attention needed to create knowledge sharing routines with external actors. Hence, we suggest that increasing both the intensity and the number of relations with external organizations may weaken firms' exploitative learning. Considering the aforementioned, the following hypothesis is formulated:

Hypothesis 2a: An inverted U-shaped relationship exists between the breadth of external knowledge search and the exploratory learning process of a firm.

Hypothesis 2b: An inverted U-shaped relationship exists between the depth of external knowledge search and the exploratory learning process of a firm.

4.2.5 The role of depth and breadth on transformative learning

Since transformative learning links the aforementioned learning processes and is path dependent on the previous knowledge base (Lane et al., 2006), we suggest that external knowledge search strategies may improve firm´s transformative capability depending on firms' level of exploratory learning. According to Garud and Nayyar (1994), transformative learning of absorptive capacity comprises two essential stages: maintaining assimilated knowledge and reactivating this knowledge (Lane et al., 2006; Marsh and Stock, 2006). However, in order to successfully retain new knowledge, firms need sufficient prior technological and market knowledge (Marsh and Stock, 2006; Teece, 2007). These two components of previous knowledge could be generated by internal R&D or by developing connections with external agents. Furthermore, scarcity of internal resources make external knowledge acquisition a more attractive option for firms looking to increase their internal knowledge base (Katila and Ahuja, 2002; Cassiman and Veugelers, 2006).

According to previous studies, firms assimilate external knowledge by integrating it into their existing knowledge base (Lenox and King, 2004). In the literature of AC, exploratory leaning specifically refers to

knowledge recognition and acquisition (Lane et al., 2006). Therefore, a firm's ability to combine new knowledge with its existing knowledge base may depend on its previous level of exploratory learning. Based on the above we suggest:

Hypothesis 3a: Exploratory learning mediates the relationship between breadth of external knowledge search and transformative learning.

Hypothesis 3b: Exploratory learning mediates the relationship between depth of external knowledge search and transformative learning.

4.2.6. The role of orientation of external knowledge search on exploratory, transformative and exploitative learning processes

To determine which types of external actors are crucial in enhancing firms´ learning processes, we introduce the orientation of a firm's external knowledge search. Depending on the knowledge need, firms might develop relationships with technological or market partners (Cohen and Levinthal, 1990; Elenkov, 1997; Lichtenthaler, 2009). Since the managerial challenges posed by the three learning processes differ, distinct components of prior knowledge may be critical in their development (March, 1991; Garud and Nayyar, 1994; Lichtenthaler, 2009). Knowledge deficiencies encourage firms to establish external networks with specific kinds of actors in order to facilitate the recognition and acquisition of new valuable knowledge (Laursen and Salter, 2006).

Previous studies suggest that interfirm differences in exploratory learning are likely determined by the existence of different levels of technological knowledge (Mowery et al., 1996; Tsai, 2001). Firms tend to have enough market knowledge because they acquire knowledge for specific applications (Todorova and Durisin, 2007), so it is the technological knowledge that determines firms' ability to identify potential external sources and to assimilate that knowledge (Lichtenthaler, 2009).

On the other hand, exploitative learning is associated with matching knowledge and markets (Rothaermel and Deeds, 2004). After assimilating external knowledge, a firm usually has an in-depth understanding of the technological knowledge (Cassiman and Veugelers, 2006). However, market knowledge thereafter determines if exploitation opportunities are discovered and in which areas they are discovered (Shane, 2000; Smith et al., 2005). Thus, interfirm differences in exploitative learning are likely influenced by market knowledge differences (Narasimhan et al., 2006).

Based on the above we expect technology partners to play a major role in developing exploratory learning and for exploitative learning, we suggest collaboration with market partners will be more important:

Hypothesis 4: Cooperating with technological partners will be mainly related to developing explorative learning processes.

Hypothesis 5: Cooperating with market partners will be mainly related to developing exploitative learning processes.

Finally, for transformative learning both components of knowledge are essential. Transformative learning links the aforementioned learning process (Lane et al., 2006) and comprises the processes of retaining and reactivating the assimilated knowledge (Garud and Nayyar, 1994; Lichtenthaler, 2009). For instance, higher level of technological knowledge has been positively related to firms' ability to maintain and reactivate additional knowledge (Garud and Nayyar, 1994). On the other hand, high level of market knowledge will help a firm in selecting the more relevant knowledge to maintain and to combine with the existing knowledge base (Marsh and Stock, 2006). Since firms´ exploratory process allow organizations to renew their knowledge base (Ahuja and Katila, 2001) and transformative learning process is path dependent of previous assimilated knowledge (Lane et al., 2006; Lichtenthaler, 2009), it is reasonable posit

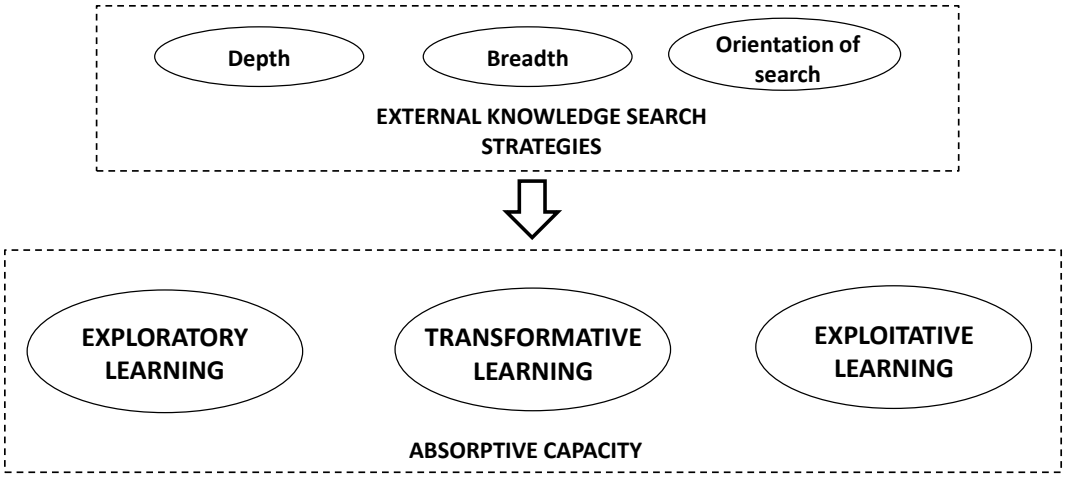
that exploratory learning mediates the effect of external knowledge search strategies on transformative learning.

Hypothesis 6a: Exploratory learning process mediates the effect of cooperating with market partners on transformative learning processes.

Hypothesis 6b: Exploratory learning process mediates the effect of Cooperating with technological partners on transformative learning processes.

In the following figure we resume the differents variables that we intend to test.

Figure 4.1 External knowledge search strategies as antecedent of absorptive capacity



4.3 METHODOLOGY AND MEASUREMENT

4.3.1 Data collection

The study focused on small, medium-sized and large industrial firms. Since some issues, such as, innovation processes and external learning might differ substantially from one industry to another, we decided to test our hypotheses in four kinds of industries in Spain: Biotechnology, ceramic, toy and footwear. Analyzing four industries with different

technology levels will add generalization power to our findings and will allow interesting comparisons among these four sectors.

The ceramic tile industry is largely globalized. Spain represents the second largest manufacturer and exporter in Europe and the third largest world exporter of tiles, surpassed only by China and Italy (IVEX, 2012). This global presence is based on superior technology and design (McDonald and Vertova, 2001; Chiva, 2004). Most of the firms in this sector are considered to be SMEs as they do not generally exceed an average of 250 workers and they tend to be geographically concentrated in industrial districts (Enright and Tenti, 1990; IVEX, 2012).

Similar to the ceramic sector, the toy industry is mainly composed of SMEs, with small firms generating around 80% of the 5,000 jobs in this industry (ICEX, 2012). This sector is characterized by the production of products with high design, quality and educational value that allow Spanish firms to compete against the mass-produced toys in China (Holmstrom, 2005; Spanish Association of Toy Manufacturers, 2012)

On the other hand, the footwear industry is a sector that does not produce any major technological changes. Rather, it takes advantage of the innovation generated by its suppliers and other local actors such as universities, research centers or related industries (Tomas et al., 2000; Molina-Morales, 2008; Martínez et al., 2012). For instance, machinery innovations allow firms to improve their productivity, while collaboration with tanners and chemical industry help footwear firms to introduce in their product the advances in term of new materials or ecological adhesives (Martínez et al., 2012). Furthermore, research centers such as the Institute of Footwear (INESCOP) provide local firms with advances, services and with the technologies generated through the international and multisectorial projects it develops (Tomas et al., 2000). According to data published by the National Statistics Institute (INE), most of the firms have less than 250 employees. Furthermore, many leather and footwear

companies base their business model on innovation activities, obtaining 21% of their turnover from new or improved products. This percentage is over 8% higher than for production activities overall, and is slightly above that for the industrial sector in terms of business derived from new and improved products (FICE, 2011).

Finally, concerning the biotechnology sector, Spain represents the 4th country in the European Union in scientific production only surpassed by the United Kingdom, Germany and France and is growing four times above the average of the rest of the countries of the European Union. While the size of the biotechnology sector in Spain is still small compared to other markets, its average growth of 15% annually, is three times higher than Germany (2nd fastest growing) and five times higher than the U.S (IVEX, 2012). Similar to the aforementioned sectors, the structure of the biotechnology sector is also characterized by a predominance of companies with fewer than 250 employees. However, since it represents a technology intensive sector, its domestic expenditure on R & D is higher (Powell et al., 1996). This indicator has experienced an increase of 11.2% in the recent years (ASEBIO, 2012).

Fieldwork was carried out from November 2011 to May 2012. To limit common method bias, we collected data for the independent and dependent variables from two informants. Following previous studies, we identified the head of R&D or similar as the first informant for the three learning processes. The second informant, with assumed expert knowledge about external knowledge search strategies was the CEO. In order to assure that the questionnaire items were fully understandable in the context of the sectors analyzed, a pre-test was carried out in 16 firms where four experts of each sector were interviewed.

Basically, the interviews reflected the insights from the literature and the informants were highly knowledgeable about the questions asked for this

study. Therefore, the framework and questions that were derived from the literature analysis were used to conduct surveys in these sectors. In order to reach a representative sample of firms from each sector we contacted by mail all those firms established in Spain to ask their participation in the study. A total of 474 firms agreed to participate in the study so we proceeded to make a personal interview with each one of them. We obtained a total of 467 (out of 474) completed questionnaires, 104 from Biotechnology, 107 from ceramic, 150 from footwear and 106 from toy firms. The sample obtained represents around 11% of the population belonging to the footwear sector (FICE, 2011), 17% of the biotechnology sector (ASEBIO, 2012), 12 % of the ceramic sector (IVEX, 2012) and 48% to the toy sector in Spain. Both, the number of responses and the response rate can be considered satisfactory (Spector, 1992; Williams et al., 2004).

4.3.2 Definitions and measurement of the constructs

External knowledge search strategies

Drawing from previous studies we measured external knowledge search strategies using three dimensions: *depth*, *breadth* and *orientation of external knowledge search* (Laursen and Salter, 2006; Chen et al., 2011). *Breadth* refers to the diversity of relations with external partners that a firm has. We included eight types of potential external partners: other enterprises within their enterprise group; suppliers of equipment, material, components or software; clients of customers; competitors and other firms from the same industry; consultants; commercial laboratories or R&D enterprises; universities or other higher educational institutes; and government or private non-profit research institutes. It was operationalized as the number of types of external partners with whom the innovating firm had a relationship. Therefore, each firm got a score of 0 when no partners were used, while the firm got a value of 8 when the firm was collaborating with all potential collaboration partners.

Depth of external knowledge search represents the intensity of relations with external partners. In a previous study Chen et al. (2011) measured it based on the score of the importance of cooperating with eight types of external agents for a firm´s innovation activities. The answers were based on an eight point likert scale, where 1 represented low importance and 8 high importance. The average of the 8 scores represented the depth of external knowledge search. The limitation of the aforementioned measure is that it does not allow us to distinguish the cases in which a firm has a very deep relation with specific external agents from those in which the firm has less deep relationships with more external partners. For instance, using the Chen et al (2011) methodology, a firm that scores an 8 for its relationship with only one external agent and gives all the others a 0 score, will score the same average as a firm that puts a value of 1 on all eight types of potential external partners. These behaviors are different; however using the above measure they would be treated as equal.

In order to refine the measure of depth, we considered that firms placing a value on an external partner from zero to four do not have a depth relationship with the external partner, whereas firms valuing external partners with a score from five to eight represent depth relationships with the specific partner. We assigned a score of zero to the former and a one to the latter. Therefore, each firm got an average of 0 when no depth relationship developed, while the firm got a value of 8 when the firm had depth collaboration with all potential partners.

Finally the orientation of openness shows how firms choose between different knowledge sources according to needs they have. Similar to Chen et al., (2011) we ran a factor analysis on the survey data of respondents to examine the importance for innovation of different external partners. The factor analysis (See section 4.4.2) grouped the 8 types of partners into two main groups: value chain partners (other enterprises within their enterprise group; suppliers of equipment,

material, components or software; clients of customers; competitors and other firms from the same industry) and technology partners (consultants; commercial laboratories or R&D enterprises; universities or other higher educational institutes; and government or private non-profit research institutes). Our analysis therefore considers these two different orientations.

Absorptive capacity

We used the measurement instrument developed by Lichtenthaler (2009) in his analyses of the process based definition of AC. According to this conceptualization, AC represents a third order construct which is formed by three different but complementary learning processes namely exploratory, transformative and exploitative learning. Each of the learning processes represent second order constructs (Lichtenthaler, 2009: 830).

Exploratory learning comprises the activities of recognizing and assimilating external knowledge. The former is measured with a five-item scale that captures a firm's activities aim at scanning and monitoring external knowledge sources (Szulanski, 1996; Jansen et al., 2005; Arbussà and Coenders, 2007). The latter is measured with a four-item scale addressing the activities aimed at absorbing knowledge from external sources (Szulanski, 1996; Jansen et al., 2005; Arbussà and Coenders, 2007).

On the other hand, Transformative learning includes the activities of maintaining and reactivating knowledge. *Maintain* is measured with four items capturing a firm's activities of retaining and storing knowledge, and the way it shares and communicates knowledge internally (Jansen et al., 2005; Smith et al., 2005; Marsh and Stock, 2006). *Reactivate* consists of four items and captures whether a firm can quickly react to opportunities by relying on its existing knowledge and firm's proficiency in addressing environmental changes by internalizing existing knowledge through

experience (Garud and Nayyar, 1994; Jansen et al., 2005; Marsh and Stock, 2006).

Finally exploitative learning is formed by the processes of *transmuting* and *applying*. *Transmute* is measured with four items and captures a firm's proficiency in combining new and existing knowledge. *Apply,* on the other hand, consists of four items and refers to a firm's proficiency in implementing technologies and adaptation in their new products (Szulanski, 1996; Jansen et al., 2005; Smith et al., 2005).

Control variables

In our study we included two control variables, which may provide possible alternative explanations for our results. Firms' size may affect the flexibility and willingness of the firms to invest in the development of AC, therefore we included the *natural logarithm* of the number of full-time employees within organizations to account for firm size (Veugelers, 1997; Jansen et al., 2005; Alegre and Chiva, 2008). Furthermore, because of our cross-industry approach we controlled for any industry effects. Previous studies have shown that knowledge strategies differ between industries (e.g. Lichtenthaler, 2007; Chen et al., 2011) so we decided to examine firms from the following sectors: ceramic, biotechnology, shoe and toy. For the first three we included a dummy (1 "pertaining to this industry"; 0 "not pertaining to this industry) (Veugelers, 1997; Licthenthaler, 2007).

4.4 ANALYSIS AND RESULTS

4.4.1 *Psychometric properties of measurement scales*

The psychometric properties of the measurement scales were assessed following previous studies (Gerbing and Anderson, 1988; Gatignon et al., 2002; Tippins and Sohi, 2003: Alegre and China, 2008) and included content validity, reliability, discriminant validity, convergent validity, and scale dimensionality.

Content validity was established through a review of extant literature and through personal interviews with managers of the ceramic, toy, shoe and biotechnology sector (four for each of the sectors). These interviews confirmed that the questionnaire items were fully understandable in the context of the sectors analyzed.

Reliability represents the ratio of the true score's variance to the observed variable's variance. Previous studies have evaluated reliability by means of Cronbach´s alpha coefficient. However, the use of Cronbach's alpha coefficient in isolation is not recommended to evaluate the reliability of a measurement scale since it does not indicate the factorial structure and the number of latent variables or the dimensions that influence the scale items (DeVellis, 1991; Alegre and Chiva, 2008). Therefore two additional indicators were used in combination with the Cronbach's alpha coefficient to assess reliability: the composite reliability (CR) and the average variance extracted (AVE).

As Shown in Table 4.1 and 4.2, the Cronbach's alpha coefficients and the composite reliability values are highly satisfactory, all above 0.7 (Nunnally, 1978; Hair et al., 1998; Iglesias, 2004). The AVE indices also exceed the minimum standard of 0.5 (Hair et al., 1998; Iglesias, 2004). Our analyses therefore support the reliability of the measurement scales.

Table 4.1 Factor correlations, means, standard deviations, and Cronbach's alphas

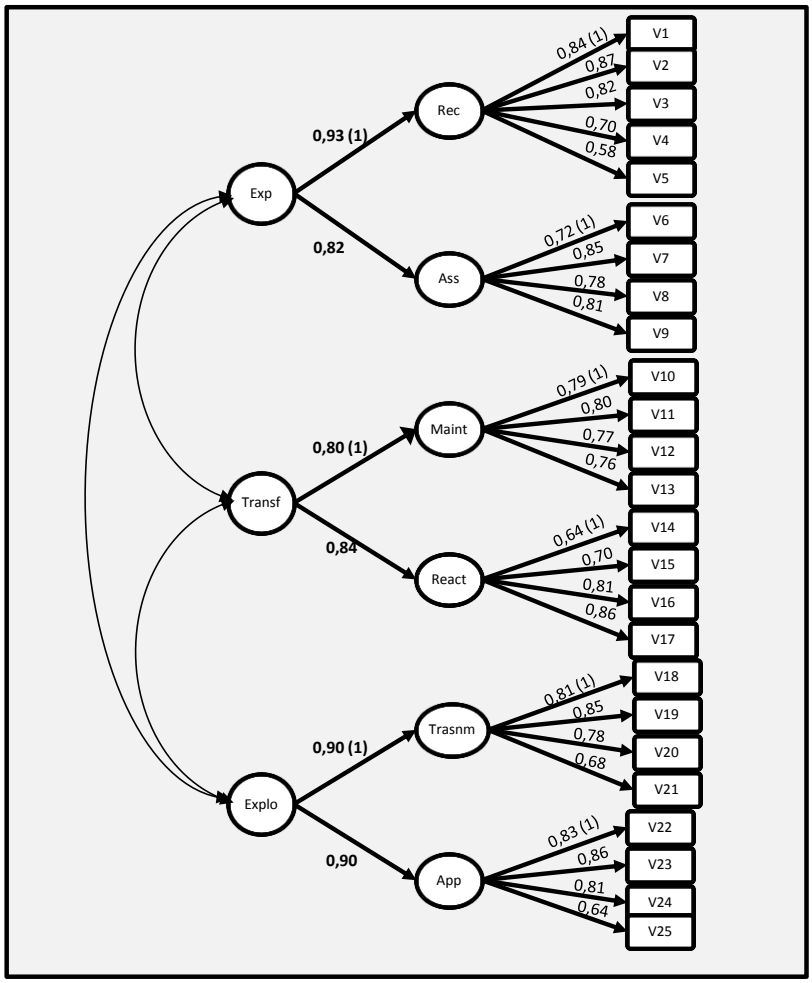
	Mean	s.d.	1	2	3	4	5	6	7	8
1. Depth	3.26	2.42								
2. Breath	4.60	2.68	0.76**							
3. Exp	5.43	1.47	0.47**	0.49**	(0.80)					
4. Trans	6.12	1.16	0.23**	0.14**	0.55**	(0.76)				
5. Expl	5.92	1.22	0.38**	0.32**	0.72**	0.76**	(0.82)			
6. Ln Empl[1]	2,74	1,38	0,27**	0,32**	0,28**	0,03	0,12**			
7. Ceramic	0,23	0,42	0,02	0,01	0,00	-0,07	-0,06	0,28**		
8. Footwear	0,32	0,48	-0,23**	-0,25**	-0,19**	-0,00	-0,08	-0,11*	-0,38**	
9. Biotech	0,22	0,42	0,42**	0,41**	0,31**	0,12*	0,22**	-0,01	-0,29**	-0,37**

Note: n = 467. **Statistically significant correlation at p < 0.01. *Statistically significant correlation at p < 0.05. Cronbach's alphas are shown on the diagonal. [1] Logarithm of the number of full-time employees

Table 4.2 Composite reliability and variance extracted of learning processes

	Composite Reliability (CR) (0.70<*p* <1)	Variance extracted (AVE) (0.50<*p* <1)
Rec	0,88	0,59
Ass	0,87	0,62
Maint	0,86	0,60
React	0,84	0,57
Transm	0,86	0,61
Apply	0,87	0,62

Figure 4.2 Confirmatory factor analysis of learning processes



CFA for Dimensions of AC
X2=681.02 (p=0.000); d.f.=266;
NFI=0.87; NNFI=0.90; CFI=0.91;
RMSEA=0.06

Note: (1) The parameter was equaled to 1 to fix the latent variable scale. Parameter estimates are standardized. All parameter estimates are significant at a 95% confidence level (t≥1.96).

We checked the constructs' ***dimensionality*** through the loadings of the measurement items on the first-order factors, and the loadings of the first-order factors on the second-order factors. All scale items load significantly on their hypothesized construct factors (Hair et al., 1998). According to Figures 4.2 standardized factor loadings are all significant ($p<0.001$) and above the recommended minimum 0.40 (Ford et al., 1986).

The ***discriminant validity*** analysis allows us to evaluate whether each of the dimensions (or subscales) used in the study measure different aspects of the concept they are related to. Discriminant validity was assessed through CFA by comparing the X^2 differences between a constrained confirmatory factor model with an inter-factor correlation set to 1 (indicating they are the same construct) and an unconstrained model with an inter-factor correlation set free. All X^2 differences were found to be significant (see Table 4.3), providing evidence of discriminant validity for the measurement scales (Anderson and Gerbing, 1988; Gatignon et al., 2002; Tippins and Sohi, 2003). CFA was also used to establish ***convergent* validity** by confirming that all scale items loaded significantly on their construct factors (Anderson and Gerbing, 1988). Additionally, convergent validity was also confirmed by comparing the X^2 differences between a constrained confirmatory factor model with an inter-factor correlation set to 0 (indicating that there is no relationship between the two constructs) and an unconstrained model with an inter-factor correlation set free. All X^2 differences in Table 4.3 were found to be significant which provides evidence of convergent validity for the measurement scales.

Table 4.3 Pairwise confirmatory analyses for organizational learning processes: estimates of correlations

	Recognize					Assimilate					Maintain					Reactivate					Transmute				
	Φ	**d.f**	**X^2**	**Δ X^2**	**p**	**Φ**	**d.f**	**X^2**	**Δ X^2**	**p**	**Φ**	**d.f**	**X^2**	**Δ X^2**	**p**	**Φ**	**d.f**	**X^2**	**Δ X^2**	**p**	**Φ**	**d.f**	**X^2**	**Δ X^2**	**p**
Ass	0,76	26	73,38		0,00																				
	1	29	251,13	177,75	0,00																				
	0	29	285,53	212,15	0,00																				
Maint	0,56	26	75,00		0,00	0,52	19	53,47		0,00															
	1	29	367,97	292,97	0,00	1	22	422,22	368,75	0,00															
	0	29	152,81	77,81	0,00	0	20	116,60	63,13	0,00															
React	0,53	26	98,54			0,41	19	84,04			0,67	19	80,55		0,00										
	1	29	412,96	314,42	0,00	1	22	520,03	435,99	0,00	1	22	205,96	125,41	0,00										
	0	27	183,33	84,79	0,00	0	20	133,95	49,91	0,00	0	20	197,09	116,54	0,00										
Transm	0,64	26	74,81			0,54	19	53,09		0,00	0,70	19	67,73		0,00	0,84	19	59,05		0,00					
	1	29	314,82	240,01	0,00	1	22	443,25	390,16	0,00	1	22	209,6	141,87	0,00	1	22	125,30	66,25	0,00					
	0	27	201,71	126,90	0,00	0	20	143,19	90,10	0,00	0	20	194,54	126,81	0,00	0	20	328,96	269,91	0,00					
Apply	0,79	26	68,09		0,00	0,76	19	49,14		0,00	0,66	19	69,3		0,00	0,61	19	95,11		0,00	0,77	19	62,99		0,00
	1	29	219,13	151,04	0,00	1	22	892,23	843,09	0,00	1	22	260,85	191,55	0,00	1	22	287,8	192,69	0,00	1	22	172,48	109,49	0,00
	0	27	281,86	213,77	0,00	0	20	250,08	200,94	0,00	0	20	178,85	109,55	0,00	0	20	205,55	110,44	0,00	0	20	250,25	187,26	0,00

4.4.2 *Measurements of the orientation of external knowledge search*

In order to measure the orientation of external knowledge search we ran a factor analysis based on the eight possible external sources (see Appendix A). The KMO (0.845) and the chi-square for Bartlett's test of sphericity (241.99) were highly significant ($p < 0.001$). The above confirm that the factor analysis is suitable for the data analyzed.

Two factors were retained according to the cumulative proportions of variance. The two factor identified reflect 60.86 % of the variance. In Table 4.4, the variables loading highly on the first factors are consultants, laboratories or R&D companies, universities or other higher education institutes, and government or private non-profit research institutes. We label this factor "Technological partners". On the other hand, the variables loading highly on the second factors are other organizations within the business group; competitors and other enterprises from the same industry; suppliers of equipment, materials and components of software; clients or customers. We label this factor "Market partners". We calculated the factor scores of each of the factors and then we used them as explanatory variables reflecting the orientation of external knowledge search.

Table 4.4 Rotated factor loadings pattern of the importance of external sources

External knowledge sources	Loadings		Name of factors
	1	2	
Other organizations within the business group	0,304	**0,601**	Market Partners
Competitors and other enterprises from the same industry	0,200	**0,732**	
Suppliers of equipment, materials, components or software	0,043	**0,816**	
Clients or customers	0,253	**0,661**	
Consultants	**0,684**	0,309	Technological partners
Laboratories or R & D companies	**0,785**	0,244	
Universities or other higher education institutes	**0,846**	0,153	
Government or private non-profit research institutes	**0,821**	0,140	

4.4.3 Results of the regression analysis

The correlations between the variables included in the empirical analysis and the descriptive statistics are listed in Table 4.1. To examine the issue of multicollinearity, we calculated variance inflation factors (VIFs) in each of the regression equations. The maximum VIF within the models was 2.78, which was well below the rule-of-thumb cut-off of 10 (Neter et al., 1990).

Tables 4.5, 4.6 and 4.7 present the results of external knowledge search strategies (depth, breadth and orientation) on learning processes. In all the models, we used firm size, and industry dummy variables as controls.

The results on exploration learning process are shown in Table 4.5. The base line model 1 contains the control variables. Model 2 introduces the effect of external knowledge search strategies on exploratory learning. Both depth ($p < 0.01$) and breadth ($p < 0.001$) presented a positive and significant effect on the dependent variable. In Model 3, we introduce the square term of the variable breadth to test whether there is an inverted U-shaped relationship between the breadth of external knowledge search

and explorative learning. In this model, the coefficient of the squared term is negative and significant. Hence, the results of Models 2 and 3 indicate that the breadth of external connections is an important factor in explaining the explorative learning process, but when firms establish too many relations with external actors, their capability to acquire and assimilate starts to decrease. Therefore, we found a curvilinear relation in Model 4 between the breadth of external knowledge search and firms' exploratory learning that corroborates hypothesis 1a.

In model 4 we introduce the square term of depth to test whether there is curvilinear relation between this variable and explorative learning. The coefficient of the variable in this case is negative and significant which means that an increase in the intensity of relations with external actors may affect negatively exploratory learning. Hypothesis 1b is confirmed.

In order to assess which types of external innovation partners have a positive effect on the exploratory learning of the respondents, based on the results of a factor analysis, we divided the external partners into two groups, technological and market partners (See section 4.2). Model 5 shows that collaborating with technological partners ($p < 0.05$) benefit the exploratory learning process. Interestingly, collaborating with market partners ($p < 0.001$) is also significant. The coefficient of this last variable is higher (0.216 vs. 0.102) and more significant ($p \leq 0.001$ vs. $p \leq 0.01$) than the one obtained for technological partners. To further analyze the strength of the effect of both orientations on exploratory learning process we assess the effect size of both variables using Cohen´s (1988) f^2 index. This effect size is calculated as the increase in R^2 relative to the proportion of variance of the endogenous latent variable that remains unexplained. Cohen (1988) indicated that f^2 values of 0.02, 0.15, and 0.35 represents small, medium and large effects, respectively. Results shows that collaborating with market partner has a higher effect ($f^2 = 0.04$) on the exploratory learning

process than collaborating with technological partners (f^2 =0.01). Hypothesis 4a is not supported.

Table 4.5 Determinants of explorative learning process

	Model 1	Model 2	Model 3	Model 4	Model 5
Control variables					
Ln Employees	0,294***	0,160***	0,166***	0,166***	0,180***
	(0,047)	(0,046)	(0,046)	(0,046)	(0,045)
Ceramic	-0,051	-0,113	-0,109	-0,102	-0,141
	(0,191)	(0,178)	(0,178)	(0,177)	(0,175)
Footwear	-0,197	-0,140	-0,126	-0,160	-0,204
	(0,171)	(0,159)	(0,158)	(0,158)	(0,159)
Biotechnology	0,997***	0,357+	0,407*	0,401*	0,348
	(0,186)	(0,188)	(0,188)	(0,188)	(0,191)
Ext. Knowledge search strategies					
Breadth		0,131***	0,123***	0,115***	
		(0,034)	(0,034)	(0,035)	
Depth		0,122**	0,115**	0,155***	
		(0,038)	(0,037)	(0,040)	
Breadth^2			-0,021*		
			(0,009)		
Depth^2				-0,025**	
				(0,010)	
Tech-partn					0,102**
					(0,032)
Mark-partn					0,216***
					(0,032)
R-square	0.174***	0.292***	0.300*	0.302**	0,308***

Note: Standard error between brackets. *** p ≤ 0.001; **p ≤ 0.01; *p ≤ 0.05; +P ≤ 0.10

The results on exploitative learning are shown in Table 4.6. Model 1 contains the control variables. In Model 2, the coefficient for depth (p < 0.001) is positive and highly significant. However, the coefficient for breadth is negative and not significant. Model 3 introduces the square term of the variable breadth. The coefficient (p < 0.10) of the variable is negative but not significant. Hypothesis 2a is not supported. In Model 4, the coefficient of the square term of the variable depth (p < 0.05) is

negative and significant which gives support to hypothesis 2b and confirms the inverted U-shaped relationship between depth of external knowledge search and exploitative learning. Model 5 tests the effect of collaborating with technological and market partners on the firms' exploitative learning process. The coefficient of both market ($p < 0.001$) and technological ($p < 0.05$) partners are positive and significant, however the effect size of market partners is higher (f^2=0.02) than the one obtained on technological partners (f^2=0.00). Hypothesis 5 is confirmed and shows that having a market orientation benefits firms in the development of the exploitative learning process.

Table 4.6 Determinants of exploitative learning process

	Model 1	Model 2	Model 3	Model 4	Model 5
Control variables					
Ln Employees	0,118**	0,035	0,039	0,040	0,036
	(0,041)	(0,042)	(0,042)	(0,042)	(0,041)
Ceramic	-0,112	-0,176	-0,174	-0,168	-0,178
	(0,168)	(0,161)	(0,161)	(0,160)	(0,159)
Footwear	-0,024	-0,004	0,006	-0,019	-0,033
	(0,151)	(0,144)	(0,114)	(0,143)	(0,145)
Biotechnology	0,601***	0,149	0,183	0,183	0,137
	(0,164)	(0,170)	(0,171)	(0,170)	(0,173)
Ext. Knowledge search strategies					
Breadth		0,020	-0,014	0,008	
		(0,031)	(0,008)	(0,032)	
Depth		0,158***	0,154***	0,184***	
		(0,034)	(0,034)	(0,036)	
$Breadth^2$			-0,014+		
			(0,008)		
$Depth^2$				-0,019*	
				(0,009)	
Tech-partn					0,070*
					(0,029)
Mark-partn					0,161***
					(0,029)
R-square	0,064***	0,153***	0,158+	0,161*	0,167***

Note: Standard error between brackets. *** $p \leq 0.001$; **$p \leq 0.01$; *$p \leq 0.05$; +$P \leq 0.10$

The results on transformative learning are shown in Table 4.7. Model 1 contains the control variables. Model 2 introduces the effect of external knowledge search strategy on the transformative learning process. The coefficient of depth ($p < 0.001$) is positive and significant; however this variable explains less than the 10% of the variance of transformative learning process. On the other hand the coefficient for breadth ($p > 0.10$) is negative and not significant. Model 3 introduces the square term of the variable breadth and the coefficient ($p < 0.10$) is negative and not significant. Model 4 introduces the square term of the variable *depth* to test whether there is an inverted U-shaped relationship between *depth* and transformative learning. The coefficient of the square term ($p > 0.10$) is negative and not significant.

Model 5 tests if collaborating with different kinds of partners helps firms to improve their transformative learning process. The coefficient of market partners ($p < 0.01$) is positive and significant, however this variable only explain 5% of the variance of transformative learning process. In the case of technological partner ($p > 0.10$), the coefficient is positive but not significant. Considering the above results, it is possible to argue that external knowledge search does not present a direct effect on firm´s ability to maintain and reactivate external knowledge. However it may be done through exploratory learning process. In the following section we test the mediating effect of this variable.

Table 4.7 Determinants of transformative learning process

	Model 1	Model 2	Model 3	Model 4	Model 5
Control variables					
Ln Employees	0,034	-0,008	-0,004	-0,004	-0,015
	(0,040)	(0,042)	(0,042)	(0,042)	(0,042)
Ceramic	-0,084	-0,133	-0,130	-0,128	-0,118
	(0,164)	(0,161)	(0,160)	(0,161)	(0,161)
Footwear	0,093	0,093	0,103	0,083	0,101
	(0,146)	(0,144)	(0,144)	(0,144)	(0,146)
Biotechnology	0,340	0,075	0,110	0,098	0,062
	(0,160)	(0,170)	(0,171)	(0,171)	(0,175)
Ext. Knowledge search strategies					
Breadth		-0,028	-0,033	-0,036	
		(0,031)	(0,031)	(0,032)	
Depth		0,132***	0,128***	0,149***	
		(0,034)	(0,034)	(0,036)	
$Breadth^2$			-0,015+		
			(0,008)		
$Depth^2$				-0,013	
				(0,009)	
Tech-partn					0,053+
					(0,030)
Mark-partn					0,077**
					(0,029)
R-square	0,017+	0,060***	0,060+	0,064	0,052***

Note: Standard error between brackets. *** $p \leq 0.001$.; **$p \leq 0.01$; *$p \leq 0.05$; +$P \leq 0.10$

4.4.4 Results of the mediating effect

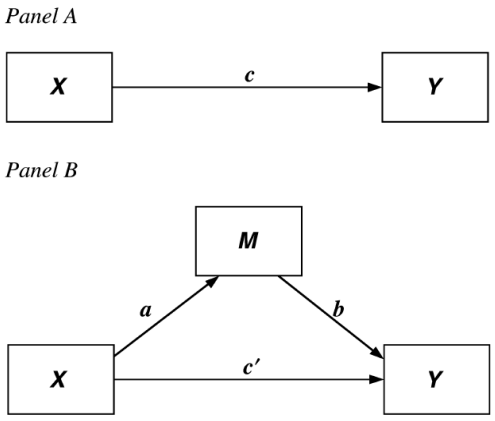
We follow Preacher and Hayes´ (2004) recommendations to analyze the mediation effect of exploratory learning on the relation between external knowledge search strategies and transformative learning process and selected the bootstrapping approach to test the significance of the indirect effect (see, e.g., Efron and Tibshirani, 1993).

Whereas the procedure outlined by Baron and Kenny (1986) involves combining the results of several hypothesis tests, using a bootstrapping approach allows us to test directly the primary question of interest, whether or not the total effect of *X* on *Y* is significantly reduced by the

addition of a mediator (M) to the model (See figure 4.3) (Preacher and Hayes, 2004).

Bootstrapping represents a nonparametric approach to effect-size estimation and hypothesis testing that makes no assumptions about the shape of the distributions of the variables or the sampling distribution of the statistic (Efron and Tibshirani, 1993). Therefore, it allows researcher to avoid the power problem introduced by asymmetries and other forms of no-normality in the sampling distribution of *ab* (Shrout and Bolger, 2002).

Figure 4.3 Illustration of a direct and an indirect effect



Note: Panel A: illustration of a direct effect. *X* affects *Y*. Panel B: illustration of a mediation design. *X* affects *Y* indirectly through *M*.

Source: Preacher and Hayes (2004)

In order to perform this analysis, we used the macro for SPSS developed by Preacher and Hayes (2008). This macro provides researchers with the ability to conduct tests of total and specific indirect effect by bootstrapping confidence intervals (percentile, BC, and BCa) at any desired confidence level. Furthermore, it is possible to add statistical control of one or more covariates that are not proposed to be mediators of the total effect (See Preacher and Hayes, 2008: 882). Preacher and Hayes´ approach for testing mediation effect requires two conditions: (1)"*there exists an effect to be*

mediated" and (2) "the indirect effect is statistically significant in the direction predicted by the mediation hypothesis" (Preacher and Hayes, 2004: 791).

Table 4.8 and 4.9 resume the results of the analysis. As it can be seen in Table 4.8, the positive significant relation between depth and transformative learning (c = 0,132***) is smaller after controlling for the level of exploratory learning (c´= 0,071) which gives some evidence of a mediating effect (See appendix 3C for the direct and the mediated model). The bootstrap output shows that the indirect effect is different from zero with 95% confidence which confirm the mediating effect of exploratory learning. Therefore, considering the two conditions established by Preacher and Hayes (2004), the mediating effect of exploratory learning in the relationship between depth on transformative learning is demonstrated. Hypothesis 3b is supported. Furthermore, the negative, albeit non-significant, total effect of breadth on transformative learning (c = -0,028) is more negative after controlling for exploratory learning (c´= -0.093). Since the bootstrap output shows that the indirect effect is different from zero with 95% confidence, the above means that the negative effect of breadth on transformative learning is reduced by introducing exploratory learning as a mediator. Hypothesis 3a is confirmed.

Table 4.9 shows that the positive and non-significant effect of technology partners (c = 0.053) on transformative learning decrease after controlling for exploratory learning (c´= 0.002). Furthermore, the positive and significant effect of collaborating with market partners (c = 0,077**) becomes non-significant after controlling for exploratory learning (c´= -0.031) which suggest a total mediation effect of exploratory learning (See appendix 3D for the direct and the mediated model). In both cases, the indirect effect is different from zero with 95% confidence. Hypothesis 6a and 6b are supported.

Table 4.8 Mediating effect of exploratory learning process on the relation between depth, breadth and transformative learning

Model	Variables	Total effect (c)	t-value	Direct effect (c´)	t-value	Indirect effect (a.b)	Percentile 95% CI		BC 95% CI		Bca 95% CI	
							Lower	Upper	Lower	Upper	Lower	Upper
1	Depth -> Transf	0,132***	3,894	0,071**	2,486	0,061	0,027	0,100	0,028	0,101	0,028	0,101
2	Breadth->Transf	-0,028	-0,890	-0,093	-3,534	0,066	0,032	0,103	0,032	0,103	0,032	0,104

Note: $R^2 = 0.348$. *** $p \leq 0.001$.; **$p \leq 0.01$; *$p \leq 0.05$; +$P \leq 0.10$

Table 4.9 Mediating effect of exploratory learning process on the relation between market partners, technological partners and transformative learning

Model	Variables	Total effect (c)	t-value	Direct effect (c´)	t-value	Indirect effect (a.b)	Percentile 95% CI		BC 95% CI		Bca 95% CI	
							Lower	Upper	Lower	Upper	Lower	Upper
1	Tech-partn -> Transf	0,053+	1,781	0,002	0,075	0,051	0,021	0,083	0,021	0,083	0,021	0,083
2	Mark-partn->Transf	0,077**	2,656	-0,031	-1,206	0,108	0,068	0,152	0,070	0,153	0,070	0,153

Note: $R^2 = 0.348$. *** $p \leq 0.001$.; **$p \leq 0.01$; *$p \leq 0.05$; +$P \leq 0.10$

4.5 DISCUSSIONS AND CONCLUSIONS

The purpose of this study has been to examine the different effects of external knowledge search strategies on a firm´s exploratory, transformative and exploitative learning processes. Although very important advances have been made in the analysis of the antecedents of absorptive capacity (e.g. Jansen et al., 2005; Pedersen and Schleimer, 2012), the link between specific managerial mechanisms and the learning processes that generate a firm's AC have not been fully analyzed. Based on the empirical results we conclude that external knowledge search strategies affect a firm´s exploratory, transformative and exploitative learning processes in different ways. Our findings deepen the understanding provided by previous studies (e.g. Jansen et al., 2005) of why certain firms are able to assimilate external knowledge but are not able to transform and exploit it successfully.

Results reveal the importance of external knowledge search strategies in enhancing a firm´s exploratory learning processes. Particularly, we find a strongly positive effect of the breadth of external knowledge search on exploratory learning. Furthermore, we find that exploratory learning is a curvilinear function of the number of relationships a firm has with different types of external agents. Increasing the diversity of partners improves a firm´s exploratory learning process up to an optimal number of partners after which the relationship turns negative. Results show that the optimal number is reached with 7 types of partners. Most of the firms in the study have external relationships with an average of 4.60 types of external agents, which is smaller than the optimum. Therefore, there is still room for Spanish firms to extend the diversity of their external relations and to improve their ability to recognize and assimilate new external knowledge.

The depth of external knowledge search also show to enhance a firm´s explorative learning processes. However, developing very intense and strong ties (measured by the square term of depth) with a limited range of partners is counterproductive for exploratory learning. One reason for this could be that developing deep relationships with external agents might lead to lower-level recognition and assimilation of new external knowledge by specific firm members, rather than involving collective processes. Maintaining deep links with external partners requires resources and attention and also increase the probability of knowledge leakage (Laursen and Salter, 2006) so an increase in the number of deep relations may have negative repercussions as one moves from the individual to the organizational level.

Concerning the orientation of the external knowledge search, contrary to our expectations, results reveal that not only collaborating with technological partners but also with value chain partners is crucial for developing an exploratory learning processes. The above means that a single focused orientation on acquiring technological knowledge may be detrimental. Since a previous knowledge base of the market is essential for firms to assimilate new technologies available at the environment (Lichtenthaler, 2009), firms may try to cover existing knowledge deficiencies by building collaboration with value chain partners. Future studies could compare low-tech with high-tech industries to see if their external orientation changes depending on the deficiencies present in any of the learning processes analyzed.

Empirical results also show that exploitative learning is a curvilinear function of the intensity (measure of depth) of relations with external agents. When firms develop depth relations with external partners, they sustain a pattern of interaction over time with a collaborator, building up a shared understanding and common ways of working together (Dyer and Singh, 1998). This close interaction facilitates knowledge sharing and the

combination of existing technologies with new market knowledge, which is essential for successfully applying new external knowledge (Dittrich and Duysters, 2007). However, increasing the intensity of relations may bring problems of knowledge leakage or about how to allocate the attention to the knowledge coming from external sources (Koput, 1997; Chen et al., 2011). Furthermore, our findings reveal that having a market and technological orientation can enhance firms´ exploitative learning processes. The above highlight the importance of having not only a market orientation for improving exploitation processes but also developing depth relations with these agents.

Interestingly, our findings indicate that increasing the number of collaborations with external firms does not have a significant effect on exploitative learning. A possible explanation could be the path dependent development of the learning processes. Although the three learning processes have distinct functions in firms utilizing external knowledge, their development seems to depend on one another (Lane et al., 2006; Zahra and George, 2002). Before developing depth relations with external agents, firms often go through a period of trial and error to learn how to gain knowledge from an external source given that *ex ante,* it is difficult for managers to know which external source will be the most rewarding before engaging in the relationship (Laursen and Salter, 2006). Therefore, increasing the number of relations may be more detrimental at the exploration phase.

The effect of external knowledge search strategies on transformative learning provides some interesting results. Firstly, although depth relations and having an orientation to collaborate with market partners show a positive effect on transformative learning, our results reveal that this effect mainly goes through exploratory learning. Furthermore, besides developing breadth relations and collaborating with technological partners may not have any significant influence on transformative

learning, our findings indicate that this effect also occur through exploratory learning. The above results go in line with previous studies and highlight the path dependence nature of transformative learning (Lane et al., 2006; Licthenthaler, 2009). Moreover, empirical analysis also shows that developing deep relations with market partners (value chain partners) is crucial for enhancing transformative learning processes since the knowledge generated may allows firms to decide which knowledge is more valuable to retain and reactive (Marsh and Stock, 2006). However, the above need to be supported by the development of mechanisms aim at facilitating the transfer and assimilation of the knowledge both at the individual and group level (Sun and Anderson, 2010). Otherwise, these actions might become detrimental for transforming the new knowledge.

The present study advances understanding of previous studies of open innovation through conceptually identifying and empirically examining how different external knowledge search strategies aim at developing depth and breadth relations contribute to a firm´s AC. This new insight may be used to explain why having too many external relations may be on occasion detrimental for innovative performance. Previous studies suggest that searching widely and deeply is counterproductive for innovative performance as a result of the increasing search cost and the potential danger of leakage of key technologies (Laursen and Salter, 2006). However, another aspect that may further explain the negative effect would be the attention that manager play to the learning processes underpinning a firm AC. Open innovation does not imply that firms simply acquire outside knowledge. Rather, they need to also generate the organization mechanisms that contribute to the assimilation, retention and application of new external knowledge (Cohen and Levinthal, 1990; Jansen et al., 2005). Therefore an increase of the number of connections and the intensity of relations with external actors need to be followed by a strategy aim at facilitating the transfer, combination and application of the new

knowledge.

From a practical perspective, our study suggests that managers should beware of the importance of developing wide and deep relations with external actor in other to improve firms´ AC. Also the study highlights the importance of collaborating with both value chain partners and technological partner when exploring the environment. However, in order to generate competitive advantage, managers need to develop strategies focused on generating synergies between the external knowledge search and the transformation and exploitation of the incorporated knowledge. Previous studies highlighted that deficiencies in transformative learning may be as detrimental as the complete lack of assimilated knowledge (Argote et al., 2003; Marsh and Stock, 2006). Therefore, managers needs to thoroughly balance the development not only the connections with technological and market partners, but also the intensity and the wide of relations. However, when the attention is in exploiting the already assimilated and transformed knowledge, the focus should be place on creating an environment that maximizes the frequency and intensity of interactions with key partner (Dyer and Singh, 1998). In both actions, managers need to bear in mind what limits are present in the actual structures and systems to allocate attention to search activities and how to solve the problems that may arise in the process (Koput, 1997).

This study has some inherent limitations which suggest also future research lines. First, the data were gathered at one point in time that prevented us from studying causal relationships among the variables analyzed. A longitudinal study may provide further insight into the dynamic of the learning processes and how they allow a firm to generate competitive advantage from knowledge coming from external sources. Also, our data was self-reported assessments of firms' managers. Although some considerations were taken to limit concerns regarding self-reported data, the issue of key informant bias and common method

variance cannot be totally ruled out.

Nevertheless, the results of the present study provide some guides for future studies. Futures research may assess how the turbulence of the environment may moderate the effect of external knowledge search strategies on the learning process that generates a firm AC. Beside previous studies have focus mainly in analyzing how the turbulence affect the outputs of the concept, such as innovative and business performance (Jansen et al., 2005; Lichtenthaler, 2009), the kind of turbulence may also act as an external activation trigger that lead a firm to search widely or deeply in the environment (Zahra and George, 2002). Other studies may assess how other internals antecedents of the exploratory, transformative and exploitative leaning process such as firm structure and human resource practices interact with the mechanism here identified in the development of a firm AC. These studies may also incorporate multiple levels of analysis and examine others individual-level as well as organization-level variables (Van Den Bosch et al., 1999).

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4.7 APPENDIX:

Table 4.10 Questionnaire items

A) Absorptive Capacity

Could you please indicate your level of agreement with the following statements about your organization?		
Dimensions	Item	Literature source
Recognize	x1: We frequently scan the environment for new technologies.	Arbussà and Coenders, (2007); Jansen et al., (2005); Szulanski, (1996); Lichtenthaler, (2009)
	x2: We thoroughly observe technological trends.	
	x3: We observe in detail external sources of new technologies.	
	x4: We thoroughly collect industry information.	
	x5: We have information on the state-of-the-art of external	
Assimilate	x6: We frequently acquire technologies from external sources	
	x7: We periodically organize special meetings with external partners to acquire new technologies.	
	x8: Employees regularly approach external institutions to acquire technological knowledge.	
	x9: We often transfer technological knowledge to our firm in response to technology acquisition opportunities.	
Maintain	x10: We thoroughly maintain relevant knowledge over time.	Jansen et al., (2005); Marsh and Stock, (2006); Smith et al., (2005); Lichtenthaler, (2009)
	x11: Employees store technological knowledge for future reference.	
	x12: We communicate relevant knowledge across the units of our firm.	
	x13: Knowledge management is functioning well in our company..	
Reactivate	x14: When recognizing a business opportunity, we can quickly rely on our existing knowledge.	Garud & Nayyar, (1994); Jansen et al., (2005); Marsh and Stock, (2006); Lichtenthaler, (2009)
	x15: We are proficient in reactivating existing knowledge for new uses..	
	x16: We quickly analyze and interpret changing market demands for our technologies.	
	x17: New opportunities to serve our customers with existing technologies are quickly understood.	
Transmute	x18: We are proficient in transforming technological knowledge into new products.	Jansen et al., (2005); Smith et al., (2005); Todorova and Durisin, (2007); Lichtenthaler, (2009)
	x19: We regularly match new technologies with ideas for new products.	
	x20: We quickly recognize the usefulness of new technological knowledge for existing knowledge.	
	x21: Our employees are capable of sharing their expertise to develop new products.	
Apply	x22: We regularly apply technologies in new products.	Jansen et al., (2005); Smith et al., (2005); Szulanski, (1996); Lichtenthaler, (2009)
	x23: We constantly consider how to better exploit technologies.	
	x24: We easily implement technologies in new products.	
	x25: It is well known who can best exploit new technologies inside our firm.	

B) Externals knowledge sources for innovation

Could you please assess the importance of the following sources of information for innovation in your organization?	
Item	Literature source
X37: Other organizations within the business group	Murovec and Prodan (2009); Chen et al. (2011)
X38: Competitors and other enterprises from the same industry	
X39: Suppliers of equipment, materials, components or software	
X40: Clients or customers	
X41: Consultants	
X42: Laboratories or R & D companies	
X43: Universities or other higher education institutes	
X44: Government or private non-profit research institutes	

Table 4.11 Effect of depth and breadth on transformative learning

Variables	Model 1				Model 2			
	Direct Model (c)	t-value	Mediated model (c´)	t-value	Direct Model (c)	t-value	Mediated model (c´)	t-value
Depth -> Transf	0,132***	3,894	0,071**	2,486				
Breadth->Transf					-0,028	-0,890	-0,093	-3,534
Depth -> Exp			0,122***	3,248				3,248
Breadth->Exp							0,131***	3,795
Exp -> Transf			0,501***	14,248			0,501***	14,248
Control								
No. Empl -> Transf	-0,088	-2,478	-0,088	-2,478	-0,088	-2,478	-0,088	-2,478
Cer -> Transf	-0,076	-0,569	-0,076	-0,569	-0,076	-0,569	-0,076	-0,569
Footwear-> Transf	0,163	1,359	0,163	1,359	0,163	1,359	0,163	1,359
Bio-> Transf	-0,104	-0,728	-0,104	-0,728	-0,104	-0,728	-0,104	-0,728
Depth -> Transf					0,071**	2,486	0,071**	2,486
Breadth->Transf	-0,093	-3,534	-0,093	-3,534				

Table 4.12 Effect of collaborating with technological and market partners on transformative learning

Variables	Model 1				Model 2			
	Direct Model (c)	t-value	Mediated model (c´)	t-value	Direct Model (c)	t-value	Mediated model (c´)	t-value
Tech-partn -> Transf	0,053+	1,781	0,002	0,075				
Mark-partn->Transf					0,077**	2,656	-0,031	-1,206
Tech-partn ->Exp			0,102**	3,156				
Mark-partn->Exp							0,217***	6,838
Exp -> Transf			0,500***	13,889			0,500***	13,889
Control								
No. Empl -> Transf	-0,105	-2,941	-0,105**	-2,941	-0,105	-2,941	-0,105**	-2,941
Cer -> Transf	-0,048	-0,353	-0,048	-0,353	-0,048	-0,353	-0,048	-0,353
Footwear-> Transf	0,204+	1,651	0,204+	1,651	0,204+	1,651	0,204+	1,651
Bio-> Transf	-0,112	-0,757	-0,112	-0,757	-0,112	-0,757	-0,112	-0,757
Tech-partn -> Transf					0,002	0,075	0,002	0,075
Mark-partn->Transf	-0,031	-1,206	-0,031	-1,206				

Capítulo 5:

External Knowledge Search Strategies, Innovation and Business Performance: Opening the black box between their relations

ABSTRACT

Nowadays it is commonly accepted that exploiting external knowledge sources is important for firms´ innovation and performance. However, it is still not clear, how this effect takes place and what internal capabilities are involved in the process. We propose to open the black box between external knowledge search strategies and innovation and performance by proposing absorptive capacity as the mediating variable. A sample of 102 Biotechnology firms from Spain is used to test the proposed theoretical model through structural equation modeling using the partial least square approach. Results suggest, firstly, that depth and breadth in external knowledge search increase innovation and performance and, second, absorptive capacity is a full mediator in the relationship between depth and innovation, and a partial mediator in the effect of depth on performance. Finally, some suggestions for managers and future lines of research are highlighted.

5.1 INTRODUCTION

A central part of the innovation process concerns the way firms go about organizing search for new ideas that have commercial potential (Laursen and Salter, 2006). While firm´s innovation capability may depend on its existing knowledge base (Subramaniam and Youndt, 2005), firms also rely on external relationships and networks in order to access knowledge located outside their boundaries or to find sources for knowledge variety that facilitate the creation and combination of new technologies (Athaide and Zhang, 2011; Cockburn and Herdense, 1998; Dyer and Singh, 1998; Huggins, 2010; Martín-de-Castro et al. 2011). This openness to external knowledge sources has been defined as "Open Innovation" and involves the use of a wide range of external actors and sources to help firms obtain the knowledge they need for their innovation processes (Chesbrough, 2003).

Recent studies point out that collaborating with a large variety of different kinds of external partners (e.g. suppliers, customers, competitors, universities, research institutes) has a positive impact on the level of novelty introduced on products and the innovation performance (Belderbos et al., 2004; Faems et al., 2005; Inauen and Schenker-Wicki, 2011). For instance, Inauen and Schenker-Wicki (2011) found that openness towards customers, suppliers and universities has a significant positive impact on firm´s innovation performance. Faems et al., (2005) suggested that firms engaging in a variety of different interorganizational

collaborations are more likely to create new or improved products that are commercially successful.

However, benefiting from searching widely and deeply is not always the case (Dahlander and Gann, 2010). For instance, some organizations may over-search by spending too much time looking for external sources of innovation (Katila and Ahuja, 2002) which is costly and time consuming and may has negative implications for the innovation performance. Building on this reasoning, Laursen and Salter (2006) found that developing depth and breadth relations increase a firm´s innovation performance up to an optimal number of partners after which it become counterproductive.

Furthermore, some recent studies found that increasing both the diversity and intensity of the relationships with their partners may have a positive effect on innovation depending on the kind of knowledge firms search outside their boundaries (Chen et al., 2011). When knowledge is tacit, the danger of knowledge leakage is lower due to its stickiness. Therefore, firm needs to develop intimate and long term relations in other to facilitate the acquisition of that knowledge (Chen et al., 2011: 366).

One plausible argument for the different findings is that the relation between openness of external knowledge search and performance is more complex than previously assumed. Save for a few exceptions, most of the empirical studies on external knowledge search strategies assume a direct causal relationship between openness behavior and innovation performance, and exclude other organizational variables that may provide a higher explanatory value to firm differences in performance. As far back as Cohen and Levinthal (1990), researchers have discussed that the ability to exploit outside sources of knowledge is largely a function of the absorptive capacity (AC) of the recipient of knowledge (Cohen and Levinthal, 1990: 128). Previous studies suggest that simple acquisition of

external knowledge does not imply successful application (Lichtenthaler, 2009; Lane et al., 2006), rather firms need to possess the mechanisms that allow them to retain, reactivate and apply the new knowledge in their product and processes (Yu-Shan et al., 2009; Daghfous, 2004; Lichtenthaler, 2009).

The present study is aimed at extending current research on firms´ openness in external knowledge search and firms´ performance by providing theoretical and empirical evidence of the mediating role that AC may plays in that relation. Particularly we hypothesize that developing depth and breadth relations with external agents leads to greater innovation and firm performance through absorptive capacity. These hypotheses are tested on a sample of 102 small and medium enterprises (SMEs) in the Biotechnology sector. The widespread reliance on inter-organizational collaborations in the biotechnology industry reflects its fundamental and pervasive concern with access to external knowledge (Powell et al., 1996), which makes this sector suitable to assess our hypotheses.

The structure of this paper is as follows. In section 5.2, we provide a literature review and propose two research hypotheses. In section 5.3, the methodology used in the empirical study and the characteristics of the sample data are described. In section 5.4, the results obtained by modeling a structural equation based on partial least squares (PLS) is described. Finally in section 5.5 the conclusions and implications are discussed.

5.2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Since no company possesses all technological resources internally (Teece, 1986), firms need to develop external links to access knowledge located outside their boundaries or to find sources of variety that facilitate the creation and combination of new technologies and knowledge (Laursen and Salter 2006; Nelson and Winter, 1982)

Thus, the newer models of innovation suggest that innovators do not work only alone. By contrast, they interact with (1) lead users, (2) suppliers, (3) competitors and with (4) a range of institutions inside the innovation system. By Inviting *users* to participate in the new product development, firms can decrease the risks associated with the introduction of the new product. Lettl et al. (2006) demonstrated that user interaction enables companies to acquire new technological skills, learn about relevant technological trends, and extend their innovation and technology-related networks. A way to reduce the cost in the design and development process is through collaboration with *suppliers* (Dyer, 1996; Nshigushi, 1994). This collaboration can foster a more flexible new product development process. Other collaborations could be with *competitors*. The reason to collaborate with competitors is to learn more about technological skills that can be difficult, time-consuming, and costly to develop internally. Normally, it is easier if the competitors have complementary R&D resources (Miotti and Sachwald, 2003). Finally, it is important to highlight collaborations with *universities and other public research institutions*. It is known that, due to the basic research that this kind of institutions is doing, it is very attractive to collaborate with them when the intention of the firm is to introduce a new breakthrough innovation or product (Belderbos et al., 2004). Furthermore, collaboration with this type of external organization could be useful for better understanding emerging scientific developments (Klevorick et al, 1995).

A proponent of this type of open innovation is Chesbrough (2003a). He suggests that the advantages firms have regarding internal R&D expenditure have declined. Consequently, many innovative firms include as sources of innovation the knowledge coming from different kinds of external actors. Open innovators commercialize external ideas by deploying both, inside-out and outside-in avenues to the market (Chesbrough, 2003b).

Previous research suggests that scanning and tracking external knowledge, and obtaining advanced technology from partners to cover gaps in technological knowledge are positively related to innovation and firm performance (Brown and Eisenhardt, 1995; Chen et al., 2009; Fabrizio et al., 2009; George et al., 2001; Rothaermel and Alexandre, 2009). For instance, Brown and Eisenhardt (1995) find that firms relying on external technology sourcing to probe and access cutting-edge knowledge held beyond the boundaries of the focal firm are more successful in introducing new products than firms focusing on internal technology sourcing. George et al., (2001) highlight the differential effect of alliance portfolio characteristics, such as structure and flow, on firm performance. Fabrizio et al., (2009) argue that investing in internal basic research and collaborations with university scientists provide search benefits in terms of both the pace of innovation and the importance of the resulting inventions. Rothaermel and Alexandre (2009) report a relationship between a firm's technology sourcing mix and firm performance. Chen et al., (2009) find that external agents, such as value chain partners, technology related organizations and universities and research labs represent effective external sources for improving firms´ innovation performance.

In sum, all the above studies highlight the importance of collaborating with external agents in order to identify new opportunities for innovation and to obtain higher performance than competitors. At the same time, some studies show that in some cases this collaboration can be negative for innovation performance (Chen et al. 2011:365). It is this point that suggests that it is important to deepen our understanding of the relationship between access to external knowledge sources and innovation and performance in order to identify whether there are variables mediating this relationship.

One way to deepen our understanding of this relationship could be through investigating breadth and depth concepts in more detail. Breadth has been defined as the number of external sources or search channels that firms rely upon in their innovation activities (Laursen and Salter, 2006:134). According to this definition, developing broad external knowledge search requires extensive effort and time to build up an understanding of the norms, habits, and routines of different external knowledge channels. However, the resulting experience and knowledge may facilitate firms' capability for recognizing and assimilating knowledge coming from new sources. Furthermore, innovative firms might draw deeply on a small number of external sources (such as lead users, suppliers, or universities). Thus, depth refers to the extent to which firms draw deeply from the different external sources or search channels (Laursen and Salter, 2006:135). This close interaction and communication with specific external agents might help firms to integrate valuable knowledge from external sources in their products or processes (Chen et al., 2011) and to obtain higher innovation and general performance. We discuss these issues next.

5.2.1 The mediating effect of absorptive capacity between depth, breadth, innovation and firm performance

According to the process based view of AC, this capability provides firms with the ability to utilize external knowledge through three sequential and complementary learning processes namely exploratory, transformative and exploitative learning (Lane et al., 2006; Lichtenthaler, 2009). Exploratory learning specifically refers to knowledge acquisition and comprises the processes of recognizing and assimilating external knowledge. Transformative learning links exploratory and exploitative learning and provides firms with the ability to maintain and reactivate knowledge acquired from external sources (Lichtenthaler, 2009; Lane et al., 2006; Garud and Nayyar, 1994). Finally, exploitative learning is

associated with matching knowledge and market opportunities (Rothaermel and Deeds, 2004) through transmuting the assimilated knowledge and applying this knowledge to commercial ends (Lane et al., 2006; Licthenthaler, 2009). The above learning processes are complementary, because their coexistence allows firms to generate synergies which facilitate obtaining higher innovation and performance results (Lichtenthaler, 2009: 839). The positive effects of AC on firm innovation and performance have also been confirmed in previous research (Yu-Shan et al., 2009; Daghfous, 2004; García-Morales et al., 2007; Lane et al., 2001; Murovec and Prodan, 2009; Tsai, 2001). For instance, García-Morales et al., (2007) suggest that firms with accumulated technological know-how and with a certain degree of technology AC are able to take advantage of the totality of technological opportunities present in the environment and increase their innovation. Murovec and Prodan (2009) highlight that different types of AC have a positive effect on process and product innovation output of firms. Yu-Shan et al. (2009), suggest that greater levels of AC allow manufacturing firms to improve their innovation performance.

Since internal R&D is limited, firms also need to establish external links in order to improve the existing knowledge base. Furthermore, access to external knowledge eases the constraints imposed on firms by a scarcity of internal resources (Gupta et al., 2006; Katila and Ahuja, 2002). Two ways for firms to search for news ideas and technologies for innovation are to develop a wide number of relations with external agents or to develop deep relations with external agents (Chen et al., 2011; Laursen and Salter, 2006).

By developing deep relations with external agents firms sustain a pattern of interaction over time and build up a shared understanding and common ways of working together (Dyer and Singh, 1998; Lane and Lubatkin, 1998). This close interaction and communication is a

prerequisite for experience-based learning (Jensen et al., 2007) and promotes AC of the knowledge receiver (Lane and Lubatkin, 1998). In inter-firm collaboration, the AC of the firm receiving the knowledge is enhanced as individuals within the collaboration get to know each other well (Dyer and Singh, 1998; Powell et al., 1996; Mowery et al., 1996; Szulanski, 1996) and develop a certain level of overlapping knowledge base (Lane and Lubatkin, 1998; Lane et al., 2001). Close interaction between firms allows them to identify who knows what and where critical expertise resides within each firm (Dyer and Singh, 1998: 665).

In this study we consider that the positive effect of depth on innovation and firm performance is achieved through absorptive capacity, which means that AC acts as a mediating variable. Therefore, we argue that while establishing depth relations with external actors facilitates access and the incorporation of new valuable knowledge for firms, absorptive capacity allows firms to successfully transform and apply the incorporated knowledge, which leads to improvement of innovation and firm performance. Accordingly, the following hypothesis is developed.

Hypothesis 1a. Absorptive capacity acts as a mediating variable between depth and innovation performance.

Hypothesis 1b. Absorptive capacity acts as a mediating variable between depth and firm performance.

Regarding breadth, previous studies suggest that connections with different kinds of actor may improve firms' AC (Murovec and Prodan, 2009; Cockburn and Herdenson, 1998). For instance, Cockburn and Herdenson (1998) argue that in order to improve AC, pharmaceutical firms need to invest not only in basic research, but also it is important for them to be actively connected to the wider scientific community. Fabrizio (2009) suggests that the degree of connectedness with university scientists allows firm researchers to identify and absorb external knowledge.

Recently, Murovec and Prodan (2009) suggested that collaborating with different types of actor, not only actors located in the value chain of the product but also with public and commercial institutions, contributes to firms' capacity to absorb both scientific and market knowledge.

We follow this line of research suggesting that breadth positively affects innovation and firm performance and that AC enhances innovation and firm performance. Consequently, the effect of breadth on innovation and firm performance goes though absorptive capacity. Then:

Hypothesis 2a. Absorptive capacity acts as a mediating variable between breadth and innovation performance

Hypothesis 2b. Absorptive capacity acts as a mediating variable between breadth and firm performance

5.3. METHODOLOGY AND MEASUREMENT

5.3.1 Sample and data collection

We test our hypothesis by focusing on small and medium-sized firms in the Spanish Biotechnology sector. By focusing on a single industry we avoid the common problem of inter-sector innovation studies, which are confounded by the fact that technological and economic diversity are different across sectors (Coombs et al., 1996). These firms are characterized by high investment in R&D and are organized in a fashion that is, comparatively, similar to a university laboratory (Powell et al., 1996). The above facilitate the creation of common technological communities between universities and Biotechnology firms (Powell et al., 1996: 2). Furthermore many of these firms are involved in joint ventures, research agreements, minority equity investments, licensing, and various kinds of partnerships to make up for their lack of internal capabilities and resources (Arora and Gambardella, 1990, 1994; Powell et al., 1996).

In Spain, the structure of firms in the biotechnology sector is characterized by a predominance of companies with fewer than 250 employees. However, since it represents a technology intensive sector, its domestic expenditure on R & D is high.

Fieldwork was carried out from November 2011 to May 2012. Following previous studies, we identify the head of the R&D or similar as the first informant for firms' AC. The second informant, with assumed expert knowledge about external knowledge search strategies and firms´ innovation and performance was the CEO. In order to assure that the questionnaire items were fully understandable in the context of the sectors analyzed, a pre-test was carried out in 4 firms. Basically, the interviews reflected the insights from the literature and the informants were highly knowledgeable about the questions asked for this study. Therefore, the framework and questions that were derived from the literature analysis were used to conduct surveys in the firms.

In order to reach a representative sample of firms from each sector we contacted by mail all those firms included in the database of ASEBIO, which represents the association of Biotechnology firms in Spain, to ask them to participate in the study. A total of 110 firms of the 617 identified in the sector agreed to participate in the study so we proceeded to do personal interviews with each of them. We obtained a total of 104 completed questionnaires. However, since two of the firms in the sample were large firms (more than 250 employees) we decided not to include them in the study to maintain a more homogeneous sample. Therefore a total of 102 biotechnology firms, which represent 17% of the target population (ASEBIO, 2012) were analyzed.

5.3.2 Definitions and measurements of the constructs

Absorptive capacity (AC): Drawing upon previous studies, we consider AC as a third order construct that is constituted by three different and complementary learning processes namely exploratory, transformative and exploitative learning processes (Lichtenthaler, 2009; Lane et al., 2006). The measures for each of these learning processes were adapted from Lichtenthaler (2009) (see Appendix). Exploratory learning comprises two activities: recognizing and assimilating external knowledge. The resulting three-items scale for recognizing (α = 0.78) evaluates firms´ ability to scan and search industry information from external sources (Arbussà and Coenders, 2007; Jansen et al., 2005; Szulanski, 1996). A three-item scale (α = 0.83) measures assimilation and captures firms' activities aimed at absorbing knowledge from external sources (Arbussà and Coenders, 2007; Jansen et al., 2005; Szulanski, 1996). Transformative learning consists of two processes: maintaining and reactivating. *Maintain* (α = 0.78) is measured with two items that assess firms´ proficiency to retain, store and share knowledge internally (Marsh and Stock, 2006; Smith et al., 2005). On the other hand, *reactivate* (α = 0.79) consists of three items, which evaluate the extent to which firms can quickly react to opportunities present in the environment by internalizing existing knowledge through experience (Garud and Nayyar, 1994; Jansen et al., 2005; Marsh and Stock, 2006). Exploitative learning includes the processes of *transmuting* and *applying*. *Transmute* (α = 0.84) is measured with three items and evaluates firms' ability to combine new and existing knowledge. Finally, *apply* (α = 0.75) consists of three items and refers to firms´ proficiency in implementing technologies and adaptation in their new products.

Firm performance and firm´s innovation performance (see Appendix): Following previous studies (Jaworski and Kohli, 1993; Reinartz et al. 2004) we measure firm performance (α = 0.89) with four items in which respondents rate the firm performance on an eight-point scale in relation to competitors. Similarly, for measuring innovation (α = 0.91) we rely in

three items in which respondents also rate firms' innovation performance on an eight-point scale in relation to competitors (Dyer and Song, (1997); Song et al., (2006).

Firms' openness of external knowledge search: The degree of openness of the external knowledge search is measured following previous studies (Chen et al., 2011; Laursen and Salter, 2006). *Breadth* is operationalized as the number of types of external partners with whom the innovating firm has a relationship. We included eight types of potential external partners (see Appendix). Each firm gets a score of 0 when no partners are used, while the firm gets a value of 8 when the firm is collaborating with all potential collaboration partners. For measuring *depth*, we refine the original measure used by Chen et al., (2011). Previously, these authors measured depth based on the score of the importance of cooperating with eight types of external agents for firms' innovation activities. The answers were based on an eight point likert scale, where 1 represented low importance and 8 high importance. The average of the 8 scores represented the depth of external knowledge search. The limitation of the aforementioned measure is that it does not allow us to distinguish the cases in which a firm has a very deep relation with 1-2 specific external agents from those in which the firm has less deep relationships with more external partners. Therefore, we consider that firms placing a value on an external partner from zero to four do not have a depth relationship with the external partner, whereas firms valuing external partners with a score from five to eight represent depth relationships with the specific partner. We assign a score of zero to the former and a one to the later. Therefore, each firm gets an average of 0 when no depth relationship is developed, while the firm gets a value of 8 when the firm has depth collaboration with all potential partners.

A control variable, which may provide possible alternative explanations for our result was included. Firms' size may affect the flexibility and

willingness of the firms to invest in the development of AC, therefore we included the natural logarithm of the number of full-time employees within organizations to account for firm size (Veugelers, 1997; Jansen et al., 2005; Alegre and Chiva, 2008).

5.3.3 Statistical Techniques

To test the proposed theoretical model, we rely on SmartPLS software (Ringle et al., 2005). In the last years, Partial Least Squares (PLS) has been used by a growing number of researchers from various disciplines such as strategic management, organizational behavior, management information system and marketing which has contributed to its popularity (Henseler et al., 2009). It is also suitable for working with small samples and for handling indirect effects (Henseler et al., 2009).

For analyzing mediating effects, the causal steps approach as described by, for example, Baron and Kenny (1986) and Judd and Kenny (1981) and has dominated the practice of statistical mediation analysis. However, recent studies have advised steering away from methods that rely on tests of significance of individual paths in a mediation model and, instead, to focus more on the indirect effect of *X* on *Y* through *M* and inferential tests thereof (See Preacher and Hayes, 2008) using approaches that respect the irregularity of the sampling distribution of the indirect effect rather than assuming it is normal. Therefore, a more powerful strategy than the Baron and Kenny approach for testing mediation may be to require only "*(1) that there exists an effect to be mediated and (2) that the indirect effect is statistically significant in the direction predicted by the mediation hypothesis*" (Preacher and Hayes, 2004: 791). We follow Preacher and Hayes (2004) recommendations to analyze the mediation effect and selected the bootstrapping approach (see, e.g., Efron and Tibshirani, 1993) to evaluate the significance of the indirect effect.

5.4. ANALYSIS AND RESULTS

5.4.1 Assessing measurement variables

In our study, reflective measurement models were used. Except for absorptive capacity, which was measured as a third order factor, all the variables were measured as first order factors. Reflective measurement models should be assessed with regard to their reliability and validity (Henseler et al., 2009). However, when a second or a higher order construct is included in the model, it needs to be previously approximated using the hierarchical component model or the method by steps (Lohmoller, 1989; Chin et al., 2003).

We selected the method by step to approximate AC (Chin et al., 2003). The criterions to assess a reflective measurement model in PLS are four: factor loading, composite reliability, average variance extracted (AVE) and discriminant validity (Chin, 1998; Henseler et al., 2009).

Factor loading. Table 5.1 shows the factor loading of all constructs involved in the study. Carmines and Zeller (1979) recommend factors loading equal to or above 0.707. The above means that the shared variance between the construct and its indicators is greater than the variance of the error. According to the table, all the items' loading were above this minimum. Since AC was measured as a third order construct, only the loading on the second order construct was included. These were also over the minimum value.

Composite reliability. The reliability of a construct evaluates the level of consistency with which the observable variables measure the latent variable (Fornell and Larcker, 1981). The traditional criterion to evaluate internal consistency is Cronbach´s α (Cronbach, 1951). However, Cronbach´s α tends to provide a severe underestimation of the internal consistency reliability of latent variables in PLS path models, therefore the

composite reliability is a more appropriate measure (Werts et al., 1974). This measure considers that indicators present different loading and its value should be higher than 0.6. The value of this index for each of the constructs analyzed in the study is shown in Table 5.1. They all exceed the minimum required level.

Convergent validity. This criterion ensures that a set of indicators represents one and the same underlying construct which is demonstrated through their unidimensionality (Fornell and Larcker, 1981). To assess the above, the value presented by the average variance extracted (AVE) index must be analyzed (Fornell and Larcker, 1981). An AVE value of at least 0.5 means, that a construct is able to explain more than half of the variance of its indicators on average (Götz et al., 2009). Table 5.1 shows that the AVE of all constructs was higher than 0.5.

Discrimant validity. This index indicates the level to with a construct is different from others constructs. With the PLS technique, the most common way of checking this validity is the Fornell-Larcker criterion (Henseler et al., 2009). This criterion consists of comparing the AVE of each latent variable with the correlation of the construct (Fornell and Lacker, 1981). For discriminant validity to exist, the square of the AVE must be higher than the correlation between the constructs. According to values in Table 5.2, the above condition is met in all cases.

Table 5.1 Measurement model results

Factors	Factor loading	SE	t-value	CR	AVE
AC				0,8804	0,7121
Exploration	0,745***	0,084	8,830		
Transformation	0,851***	0,050	16,897		
Explotation	0,926***	0,018	52,721		
Innovation				0,941	0,842
INN01	0,905***	0,028	32,537		
INN02	0,948***	0,016	58,575		
INN03	0,898***	0,028	31,700		
Performance				0,924	0,752
PERF01	0,757***	0,064	11,816		
PERF02	0,885***	0,031	28,801		
PERF03	0,919***	0,025	37,216		
PERF04	0,900***	0,028	32,236		
Breadth	1,000	0,000	0,000	1,000	1,000
Depth	1,000	0,000	0,000	1,000	1,000
No. Empl	1,000	0,000	0,000	1,000	1,000

Note: +p ≤0,1 *p≤ 0,05 **p≤ 0,01 ***p≤0,001; t- values for n = 500 subsamples; CR, composite reliability; SE, standard error; average variance extracted

Table 5. 2 Discriminant validity analysis

	1	2	3	4	5	6
1. AC	(0,844)					
2. Breadth	0,164	(1,000)				
3. Depth	0,324	0,655	(1,000)			
4. Innovation	0,467	0,381	0,385	(0,917)		
5. Performance	0,318	0,062	0,231	0,474	(0,867)	
6. Ln_Empl	0,052	0,060	0,130	0,100	0,112	(1,000)

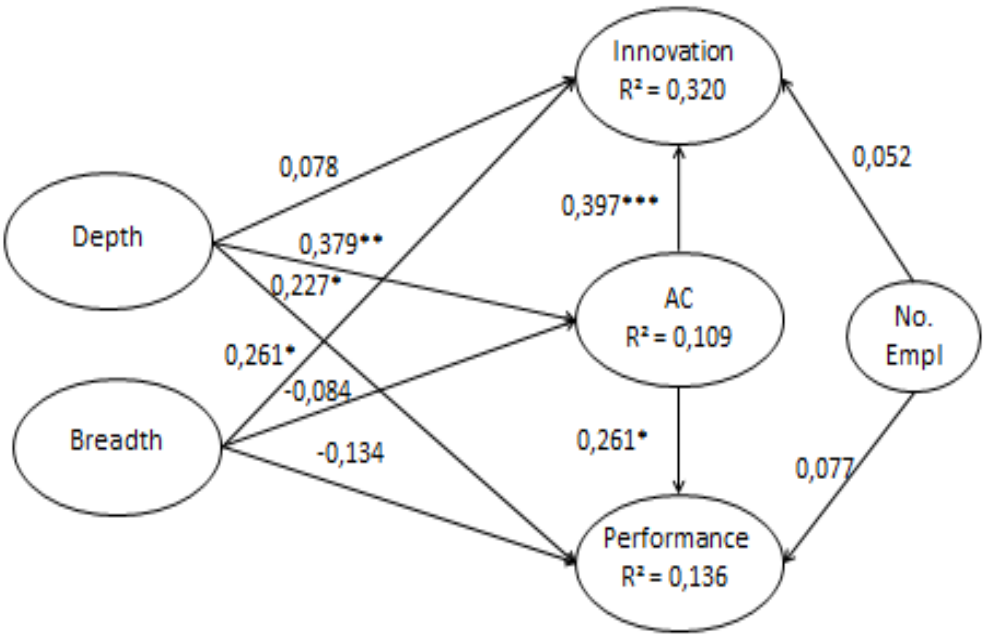
Note: Diagonal elements are the square root of the AVE; off-diagonal elements are the correlations among constructs.

5. 4.2 Assessing the structural model

The essential criterions for the evaluation of the structural model are the coefficient of determination (R^2) of the endogenous latent variables and the strength of the relationships between the constructs (Chin, 1998).

Bootstrapping was used to generate standard errors and t-statistics. Following Chin's (2001) recommendations, the bootstrap estimates presented here are based on 500 bootstrap samples. The values and the significance levels of the path coefficients, together with the R^2 coefficients for each of the endogenous constructs are shown in figure 5.1.

Figure 5.1 Complete causal model



Note: *p ≤0,1 **p≤ 0,05 ***p≤ 0,01 ****p≤0,001

The R^2 value of the dependent latent variable was used to determine the amount of variance explained by the model. According to Falk and Miller (1992), this index must be higher than 0.1, which ensures that at least 10 percent of the construct variability derives from the model. Lower R^2 values, in spite of being significant, provide very little information, so the hypothesis concerning this latent variable cannot be sustained.

In Figure 5.1, the R^2 index of the innovation variable indicates that the theoretical model explains 32 percent of the variance of the construct, which can be considered as moderated. When the exogenous latent

variable is explained by a few exogenous latent variables, "moderate" R^2 are considered as acceptable (Chin, 1998; Henseler et al., 2009: 303) so we can conclude that our model has adequate predictive power for innovation. On the other hand, the R^2 value of the firm performance construct suggests that the model explain only 14 percent of this variable. While this value may be considered low, it is higher than the minimum required of 0.1 (Falk and Miller, 1992: 80).

In order to analyze the mediating effect of AC, the total effect and the indirect effect need to be analyzed (Preacher and Hayes, 2008; 2004). As it can be obserbed in Table 5.3, the total effect of depth on innovation and firm performance is significant and different from zero. In the case of breadth, the results showed that breadth only have a significant effect on innovation. After controlling for the level of AC present at the firm, the coefficients of the direct effect of depth on innovation and firm performance decrease. An important aspect to highlight is that in this step the relation between depth and innovation becomes not significant. The bootstrap outputs in Table 5.3 show that the indirect effect of depth through AC on innovation and firm performance are statistically significant and different from zero with 95% confidence. Therefore, considering the two conditions established by Preacher and Hayes (2004: 719), Hypothesis 1a and 1b are supported. On the other hand, when analyzing the direct effect of breadth on innovation and firm performance, only the effect on innovation seems to increase after controlling for AC. The confidence intervals for each indirect effect of breadth on innovation and performance through AC include the 0, which means that the indirect effect is not statically different from zero (Preacher and Hayes, 2004: 722). Hypothesis 2a and 2b are no supported.

Table 5.3 Analysis of the mediating effect

	Total effect (c)	t-value	Direct effect (c´)	t-value	Indirect effect (a.b)	t-value	Percentile	
							Lower	Upper
Depth -> Inn	0,229*	1,931	0,078	0,721	0,151***	3,440	0,047	0,314
Depth -> Perf	0,326**	3,067	0,227*	2,070	0,099**	2,446	0,011	0,251
Breadth -> Inn	0,228+	1,643	0,261*	2,254	-0,033	-2,405	-0,147	0,071
Breadth -> Perf	-0,156	1,241	-0,134	1,115	-0,022	-2,210	-0,121	0,047
AC -> Inn	0,397***	4,816	0,397***	4,816				
AC -> Perf	0,261*	2,334	0,261*	2,334				
Breadth -> AC	-0,084	0,675	-0,084	0,675				
Depth -> AC	0,379**	3,091	0,379**	3,091				
No. Empl -> Inn	0,052	0,598	0,052	0,598				
No. Empl -> Perf	0,077	0,853	0,077	0,853				

Note: +p ≤0,1 *p≤ 0,05 **p≤ 0,01 ***p≤0,001. t- values for n = 500 subsamples

To further analyze the mediation effect, we assess the strength of the effect of AC using Cohen´s (1988) f^2 index. This effect size is calculated as the increase in R^2 relative to the proportion of variance of the endogenous latent variable that remains unexplained. Cohen (1988) indicated that f^2 values of 0.02, 0.15, and 0.35 represents small, medium and large effects, respectively. According to values included in the Table 4 we can conclude that AC has a medium predictive relevance on the variance of the innovation variable ($f^2 = 0.20$) and that the predictive power is smaller in the case of the firm performance variable. However, in both cases the strength of the effect of AC is higher than the effect of depth and breadth.

Table 5.4 Effect size

Effect	R^2 Included	R^2 No included	f^2
Depth -> Inn	0,32	0,32	0,00
Depth -> Perf	0,14	0,11	0,03
Breadth -> Inn	0,32	0,28	0,06
Breadth -> Perf	0,14	0,13	0,01
AC -> Inn	0,32	0,18	0,20
AC -> Perf	0,14	0,08	0,07

Note: f^2 values of 0.02, 0.15, and 0.35 represents small, medium and large effects

5.5 CONCLUSION AND IMPLICATIONS

Although previous studies have been devoted to analyze independently the benefits that searching widely and deeply have on firm innovation, the importance of AC in mediating this relation have not been fully analyzed. Our theoretical framework demonstrated that the value of openness of external knowledge search on innovation and firm performance is better explained by considering AC as a mediator in the relationship.

The study contributes to literature on absorptive capacity and open innovation in several ways. Most importantly, the results indicate that AC partially mediates the effect of depth on firm performance and acts as a full mediator in the effect on innovation. The latter specifically implies that sustaining deep relations with certain type of actors influence indirectly firms´ innovation performance by mainly improving firms´ AC. Therefore, AC may represent the essential capability that allows firms adopting an open innovation strategy to generate superior new product development programs and better profitability.

The importance of AC may be more significant in a high technology sector such as Biotechnology. In this sector, external partners are, in many cases, the most important sources of new ideas for generating innovations and for improving performance (Dyer and Singh, 1998; Powell et al., 1996). Since the kind of knowledge this type of firm acquires from external sources consists mainly of very scientific and technological knowledge, they need to develop interaction routines that increase the frequency of interaction and the level of trust between collaborating members. Therefore, developing deep relations with external actors must be supported by certain organizational conditions that facilitate the absorption of the new knowledge and have positive implications for performance.

Our study provides evidence of the importance of certain organizational learning processes, which define a firm´s AC, for deep external relations to have an impact on a firm´s innovation and firm performance. These learning processes together seem to catalyze the effect of depth relations on performance, specifically on innovation performance. However, depth relations may have little direct effect on innovation performance if the ability to assimilate, transform and apply that knowledge is not facilitated.

Furthermore, the mediating role of AC may explain previous contradictory findings (e.g. Laursen and Salter, 2006; Chen et al., 2011). Close relations with external partners facilitate mainly the access and the acquisition of new valuable knowledge (Lane and Lubatkin, 1998). However, profiting from assimilated knowledge generally requires exploitative learning (Rothaermel and Deeds, 2004). This process allows firms to identify potential application of the new knowledge and successfully convert it in new products. Low innovation performance may be a consequence of the failure of the firm to maintain and reactivate its knowledge. The above might be as detrimental as the complete lack of assimilated knowledge (Marsh and Stock, 2006). Therefore, given the complementarily and path dependent nature of the three learning processes that generate a firm´s AC (Lane et al., 2006), considering AC might give us a more complete picture of why some firms might manifest low performance even while they exhibit a clear openness to external knowledge sources.

The effect of breadth on innovation and performance provides somewhat surprising results. Firstly, although previous studies have argued that breadth collaboration may improve firms´ innovation and firm performance, our results did not support this argument. Furthermore, AC was not the mediator variable in this relation that we predicted. One reason for these results could be that breadth relations might not be relevant for developing innovation in the Biotechnology sector due to the

characteristics of knowledge that is sought. In order to successfully acquire and apply complex, scientific, external knowledge, biotechnology firms need to sustain close relations with external partners (Powell et al., 1996).

From a practical perspective, our study suggests that managers should beware of the importance of AC in the link between external knowledge search strategy and innovation and firm performance. Developing deep relations with external actors can facilitate access to valuable knowledge, which is essential for increasing exploratory learning (Lichtenthaler, 2009). However, firms need also to possess the ability to assimilate, maintain and apply the external knowledge since an excessive focus on only one learning process likely has negative consequences (Lane et al., 2006; Zahra and George, 2002). Therefore, in order to generate competitive advantage in the Biotechnology industry, managers need to develop strategies focused on generating synergies between the external knowledge search and the transformation and exploitation of the incorporated knowledge.

This study has some inherent limitations which may suggest also future research lines. First, the data were gathered at one point in time. A longitudinal study may provide further insight into the dynamic of the learning processes that take place inside the firm and how they allow organizations to generate competitive advantage from knowledge coming from external sources. Second, the target population was narrowly defined to include a fairly homogenous set of firms which limits the generalization of research results. Future studies could analyze our findings in other industries.

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5.7 APPENDIX

Table 5.5 Questionnaire items

A. Absorptive Capacity Measurement Scale

Could you please indicate your level of agreement with the following statements about your organization?		
Dimension	Item	Literature source
Recognize	X1: We frequently scan the environment for new technologies.	Arbussà and Coenders, (2007); Jansen et al., (2005); Szulanski, (1996); Lichtenthaler, (2009)
	X2: We thoroughly observe technological trends.	
	X3: We observe in detail external sources of new technologies.	
Assimilate	X4: We periodically organize special meetings with external partners to acquire new technologies.	
	X5: Employees regularly approach external institutions to acquire technological knowledge.	
	X6: We often transfer technological knowledge to our firm in response to technology acquisition opportunities.	
Maintain	X7: We thoroughly maintain relevant knowledge over time.	Jansen et al., (2005); Marsh and Stock, (2006); Smith et al., (2005); Lichtenthaler, (2009)
	X8: Employees store technological knowledge for future reference.	
Reactivate	X9: When recognizing a business opportunity, we can quickly rely on our existing knowledge.	Garud and Nayyar, (1994); Jansen et al., (2005); Marsh and Stock, (2006); Lichtenthaler, (2009)
	X10: We quickly analyze and interpret changing market demands for our technologies.	
	X11: New opportunities to serve our customers with existing technologies are quickly understood.	
Transmute	X12: We are proficient in transforming technological knowledge into new products.	Jansen et al., (2005); Smith et al., (2005); Todorova and Durisin, (2007); Lichtenthaler, (2009)
	X13: We regularly match new technologies with ideas for new products.	
	X14: We quickly recognize the usefulness of new technological knowledge for existing knowledge.	
Apply	X15: We regularly apply technologies in new products.	Jansen et al., (2005); Smith et al., (2005); Szulanski, (1996); Lichtenthaler, (2009)
	X16: We constantly consider how to better exploit technologies.	
	X17: It is well known who can best exploit new technologies inside our firm.	

B. Sources of Information for Innovation Measurement Scale

Could you please assess the importance of the following sources of information for innovation in your organization?	
Item	Literature source
X37: Other organizations within the business group	Murovec and Prodan (2009); Chen et al. (2011)
X38: Competitors and other enterprises from the same industry	
X39: Suppliers of equipment, materials, components or software	
X40: Clients or customers	
X41: Consultants	
X42: Laboratories or R & D companies	
X43: Universities or other higher education institutes	
X44: Government or private non-profit research institutes	

C. Innovation Performance Measurement Scale

Could you please indicate your level of agreement with the following statements about your organization?	
Item	Literature source
X45: The overall performance of our new product development program has met our objectives.	Dyer and Song, (1997); Song et al., (2006)
X46: From an overall profitability standpoint, our new product development program has been successful.	
X47: Compared with our major competitors, our overall new product development program is far more successful.	

D. Firm Performance Measurement Scale

Please state your firm performance compared to that of your competitors with regard to the following items	
Item	Literature source
X48: Customer loyalty	Jaworski and Kohli, (1993); Reinartz et al. (2004)
X49: Sales growth	
X50: Profitability	
X51: Return on investment	

Capítulo 6:

Conclusiones generales

6.0 INTRODUCCIÓN

Esta tesis nos ha permitido aclarar cómo distintas acciones promovidas por los directivos tanto a nivel interno como externo inciden sobre el desarrollo de la capacidad de absorción de las organizaciones. Asimismo, nos ha proporcionado un mayor entendimiento de por qué las estrategias de búsqueda de conocimiento externo por si solas no son suficientes para explicar las diferencias en el desempeño de las empresas. Esto último se debe principalmente a que es necesario tomar en cuenta qué tipo de capacidad interna es la que permite a las organizaciones asimilar, transformar y explotar el conocimiento adquirido de manera eficiente. Nuestros resultados muestran que para poder comprender cómo las organizaciones desarrollan capacidad de absorción, es necesario profundizar en el efecto que tienen sus antecedentes sobre las dimensiones que lo conforman.

En este último capítulo se muestran las conclusiones finales de los tres artículos con el objetivo de proporcionar al lector una visión clara de los estudios presentados tras la lectura de la introducción y el marco teórico general. Para ello presentamos de forma esquemática cada una de las conclusiones de los artículos y posteriormente las contribuciones teóricas e implicaciones prácticas de forma conjunta. Para finalizar el capítulo se incluye un apartado de limitaciones y futuras líneas de investigación.

6.0.1 Conclusiones del capítulo 3 (artículo 1): Organizational Learning Facilitating Factors: An Analysis of Their Effect on Firm´s Absorptive Capacity

Este estudio trata de cubrir el gap identificado en investigaciones previas en las que se señala la necesidad de profundizar en el entendimiento de cómo determinadas acciones llevadas a cabo por los directivos repercuten en el desarrollo de la capacidad de absorción a nivel organizativo. Para ello, tomando como base la definición basada en los procesos de la capacidad de absorción y apoyados en la literatura sobre aprendizaje organizativo evaluamos cómo distintos factores dirigidos a facilitar el aprendizaje inciden en los procesos de exploración, transformación y explotación del conocimiento.

En particular, los resultados ponen de relevancia que la promoción del diálogo, la experimentación y la toma de riesgo son necesarios para mejorar no sólo los procesos de exploración del conocimiento sino que también son importantes para promover el aprendizaje transformador y explotador. Por un lado, estos resultados contradicen a estudios previos en los que se señala que la promoción de tácticas de socialización o el incremento del nivel de conectividad entre los recursos humanos podría limitar el desarrollo de procesos de búsqueda de conocimiento externo, disminuyendo con ello el aprendizaje explorador (Jansen et al., 2005; Nahapiet and Goshal, 1998; Janis, 1982). No obstante, en el contexto de capacidad de absorción los peligros de inercia son limitados, ya que las organizaciones tratan continuamente de renovar la base de conocimiento existente (Leonard-Barton, 1992). Además, para promover la asimilación del conocimiento externo a nivel organizativo, este debe ser transferido desde los responsables de su búsqueda a las distintas unidades o departamentos correspondientes. Ante este contexto, la promoción del diálogo para mejorar los niveles de confianza y de familiaridad entre los miembros es esencial, ya que esto puede contribuir a crear un

entendimiento de la información que ha sido intuida a nivel individual (Nonaka y Takeuchi, 1995).

Por último, con respecto a la participación en la toma de decisiones, comprobamos que este factor contribuye a mejorar los procesos de exploración de conocimiento. Sin embargo, cuando la organización pasa a transformar dicho conocimiento, el seguir manteniendo el poder distribuido entre un gran número de empleados puede llegar a restar eficacia a la correcta ejecución de esta actividad. Por lo antes expuesto, este capítulo pone de manifiesto que las diferencias inter organizativas respecto a los niveles de capacidad de absorción pueden surgir como fruto de la promoción a nivel interno de aquellos factores que facilitan el desarrollo de aprendizaje explorador, transformador y explotador.

6.0.2 Conclusiones capítulo 4 (artículo2): The role of openness in explaining firms´ absorptive capacity

En este artículo partimos de estudios previos que proponen las conexiones establecidas con distintos agentes externos como factor determinante de la capacidad de absorción (Murovec y Prodan, 2009; Lane et al., 2006; Lane y Lubatkin, 1998). En este estudio profundizamos sobre estas relaciones y mostramos cómo distintas estrategias de búsqueda de conocimiento externo como son el desarrollo de nexos fuertes con agentes (depth), el establecimiento de relaciones con un amplio número de actores externos (breadth) o la orientación de la búsqueda de conocimiento (tecnológica o de mercado); contribuyen de manera distinta a las dimensiones de la capacidad de absorción. Nuestros resultados revelan la importancia que tiene el desarrollo de nexos fuertes y las conexiones con un amplio número de agentes en la mejora del aprendizaje explorador. Sin embargo, el uso de ambas técnicas para facilitar el acceso y la asimilación de conocimiento externo debe hacerse con precaución, ya que el incremento del número o la intensidad de las relaciones más allá de los límites organizativos pueden ser nocivos para el correcto desarrollo del

aprendizaje explorador. En el caso del aprendizaje explotador las empresas podrían mejorar su capacidad de integrar el conocimiento adquirido en los productos o servicios que ofrece principalmente a través del establecimiento de colaboraciones profundas con agentes claves. Esto se debe a que la aplicación de conocimiento nuevo externo depende en gran medida de la existencia de nexos fuertes o de modelos de interacción preestablecidos entre las empresas que colaboran (Dyer y Singh, 1998; Dittrich y Duysters, 2007). Sin embargo, al igual que ocurre con el aprendizaje explorador, un exceso en la intensidad de las relaciones puede resultar perjudicial para los procesos de explotación del conocimiento.

Al evaluar el efecto que tiene la orientación de la búsqueda de conocimiento sobre el aprendizaje explorador y explotador observamos que la colaboración tanto con agentes tecnológicos como de mercado es beneficiosa para la mejora de ambos tipos de aprendizaje. No obstante, nuestros resultados señalan que la colaboración con agentes del mercado presenta un mayor peso en el desarrollo de ambos procesos de aprendizaje. Lo anterior resalta la importancia que tiene mantener colaboraciones estrechas con los distintos agentes que forman la cadena de valor (es decir, los agentes de mercado) tanto en la búsqueda de nuevo conocimiento como en su aplicación.

Por último en lo que respecta al aprendizaje transformador, nuestros hallazgos señalan que las estrategias de búsqueda de conocimiento externo no presentan un efecto directo considerable sobre este tipo de aprendizaje, sino que esta relación ocurre principalmente a través del nivel de aprendizaje explorador presente en la organización. Estos resultados van en línea con estudios previos en los que se destaca la naturaleza de la línea de dependencia (path dependence) del aprendizaje transformador (Lichtenthaler, 2009; Lane et al., 2006). Por lo cual, para que las organizaciones sean capaces de mantener y reactivar conocimiento externo estas necesitan haber invertido previamente en el desarrollo de los

mecanismos que faciliten la correcta transferencia y asimilación de conocimiento tanto a nivel individual como grupal (Sun y Anderson, 2010).

6.0.3 Conclusiones capítulo 5 (artículo 3): External knowledge search strategies, innovation and business performance: Opening the black box between their relations.

Recientemente se ha discutido que la apertura de los procesos de innovación, en particular el desarrollo de relaciones con un amplio número de agentes externos o el desarrollo de nexos fuertes con agentes claves contribuyen tanto al desempeño general como al desempeño innovador de las organizaciones. Sin embargo, en algunos de los casos, las relaciones encontradas entre estos dos grupos de variables han sido contradictorias (por ejemplo: Chen et al., 2011; Lausen and Salter, 2006). Tratamos de dar respuesta a esta controversia de resultados probando que dichas diferencias se deben a que no existe una relación directa entre la estrategias de búsqueda de conocimiento externo y el desempeño en innovación, sino que esta relación se produce de forma indirecta mediante la existencia de capacidad de absorción.

Nuestros resultados muestran que la capacidad de absorción media parcialmente el efecto de los vínculos con agentes externos sobre el desempeño organizativo y que además, ejerce una mediación total en el efecto de este tipo de vínculos sobre el desempeño innovador. Por lo antes expuesto, la capacidad de absorción representa una capacidad esencial que permite a las organizaciones que adopten estrategias de innovación abierta, así como generar mejores programas de desarrollo de nuevos productos y además, obtener un mayor desempeño financiero que la competencia. Del mismo modo, los resultados señalan que en sectores de alta tecnología, como es el caso del sector de biotecnología, el desarrollo de relaciones con un gran número de agentes externos no tiene un peso considerable en la mejora del desempeño innovador y del desempeño

general de este tipo de organizaciones. Este hecho se podría deber a las características del conocimiento que este tipo de organizaciones buscan a nivel externo. Según declaran Powell et al. (1996), para poder adquirir y aplicar con éxito el conocimiento científico disponible en las fuentes externas, las empresas de biotecnología necesitan sostener relaciones cercanas con las fuentes que poseen el conocimiento.

6.1 CONTRIBUCIONES E IMPLICACIONES

Consideramos que esta tesis realiza contribuciones importantes a nivel académico (de carácter tanto teórico como empírico) y a nivel práctico (para directivos y agentes responsables de las políticas públicas). A continuación se exponen algunas de estas contribuciones y las implicaciones en cada caso.

En primer lugar, damos un paso importante a nivel académico al proporcionar un mayor entendimiento de los vínculos existentes entre la capacidad de absorción y el aprendizaje organizativo. A pesar de que en sus inicios el concepto de capacidad de absorción se construyó sobre las bases de las teorías y trabajos sobre aprendizaje organizativo (por ejemplo: Cohen y Levinthal, 1990; Lane y Lubatkin, 1998), pocos estudios hasta el momento habían abordado explícitamente estas relaciones. Estudios recientes muestran que ambos conceptos guardan cierta afinidad conceptual y además, presentan similitud de antecedentes (por ejemplo: Sun y Anderson, 2010; Lane et al., 2006). Estos avances sumados con la nueva concepción dinámica del concepto (por ejemplo: Zahra y George, 2002) han llevado a la capacidad de absorción a posicionarse como un tipo de capacidad dinámica que permite a las organizaciones hacer frente a los continuos cambios del entorno a través de la exploración, transformación y explotación del conocimiento externo.

Aunque estudios previos como los realizados por Jansen et al. (2005), Vega-Jurado et al. (2008) o recientemente Pedersen y Schleimer (2012)

investigan cómo distintos factores internos afectan a la capacidad de absorción potencial (PACAP) y realizada (RACAP) de las organizaciones, hasta el momento no se ha analizado el impacto de los distintos factores internos sobre los diferentes procesos de aprendizaje que conforman esta capacidad.

En la literatura sobre capacidades dinámicas son varios los autores que, de manera explícita, subrayan el papel central que juega el aprendizaje organizativo en el desarrollo de capacidades dinámicas (Lichtenthaler, 2009; Easterby-Smith y Prieto, 2008; Sirmon et al. 2007; Madhok y Osegowitsh, 2000). Según establece, Eisenhardt y Martin (2000) la clave para el desarrollo de capacidades dinámicas radica en la reconfiguración del conocimiento organizativo a partir de la cual, las organizaciones generan o mejoran sus capacidades. Nuestro estudio contribuye a esta línea de pensamiento y además, extiende las investigaciones sobre los antecedentes de gestión. De manera concreta, demostramos empíricamente que determinadas acciones llevadas a cabo por los directivos contribuyen al desarrollo de la capacidad de absorción. Esto tiene lugar principalmente a través de su impacto sobre los procesos de aprendizaje. Por ello, al igual que Sun y Anderson (2011), defendemos que es necesario seguir profundizando sobre las conexiones entre el aprendizaje organizativo y la capacidad de absorción. Dichas investigaciones permitirían crear una compresión más rápida y profunda de cómo las organizaciones pueden construir eficazmente la capacidad de absorber conocimiento externo a partir de la promoción de los factores que faciliten el aprendizaje a nivel organizativo.

Esta tesis también presenta importantes implicaciones para las investigaciones sobre innovación abierta (open innovation) y la capacidad de absorción. Por un lado, aunque estudios previos sobre los antecedentes de la capacidad de absorción han prestado una gran atención a los aspectos inter-organizativos (Por ejemplo: Sun y Anderson, 2010; Murovec

and Prodan, 2009; Easterby-Smith et al., 2008; Fabrizio, 2009; Jansen et al., 2005), pocos de estos estudios han evaluado el papel de las estrategias de búsqueda de conocimiento externo en la mejora o desarrollo de los procesos de aprendizaje que dan origen a esta capacidad. Por ejemplo, estudios previos señalan que las organizaciones que participan de redes de colaboración inter-organizativas tienden a presentar altos niveles de capacidad de absorción (Powell et al., 1996; Stuart, 1998). La asunción de varios de estos estudios es que el conocimiento tecnológico disponible en estas redes puede ser utilizado por las organizaciones sin tener que incurrir en costos adicionales. Sin embargo, según señalan Cohen y Levinthal (1990), para beneficiarse del conocimiento externo es necesario que las organizaciones inviertan previamente en el desarrollo de la capacidad de absorción. Nuestro estudio da validez empírica al argumento de Cohen y Levinthal (1990) y muestra la necesidad de que las organizaciones envueltas en redes de colaboración, establezcan previamente las estructuras y los procesos que faciliten el flujo continuo del conocimiento para así mejorar no sólo su adquisición, sino también su transformación y explotación.

Asimismo, cabe destacar que nuestro estudio proporciona una base adicional para explicar la existencia de resultados contradictorios acerca del efecto de la colaboración inter-organizativa y el desarrollo de capacidad de absorción. A pesar de que el desarrollo de vínculos con agentes externos pueda beneficiar la mejora de la capacidad de absorción (Murovec y Prodan, 2009), nuestro estudio señala que un exceso en el número o en la intensidad de dichas relaciones puede, a su vez, repercutir negativamente sobre los procesos de aprendizaje de las organizaciones. Este efecto negativo puede surgir como fruto de la dificultad que experimentan las organizaciones para distribuir la atención necesaria a todas las conexiones y canales de comunicación establecidos (Ocasio, 1997). De este modo, a parte de los posibles riesgos de que información

privilegiada se filtre al mercado o de los costos de gestión en los que las organizaciones deban incurrir tras el incremento de las relaciones externas (Laursen y Salter, 2006; Katila y Ahuja, 2002), nuestra investigación señala que también es importante prestar atención a las deficiencias en aprendizaje que las organizaciones puedan experimentar y a los mecanismos que los directivos desarrollen a nivel interno para apalear dichas deficiencias.

Los procesos de innovación abierta no implican que las organizaciones adquieran conocimiento externo sin ningún esfuerzo (Laursen y Salter, 2006). Por el contrario, las empresas necesitan desarrollar los mecanismos organizativos que contribuyan a la asimilación, retención y aplicación del conocimiento nuevo. Por lo cual, un incremento del número de conexiones o de la intensidad de los vínculos con agentes externos necesita ser respaldada con el desarrollo de los mecanismos que faciliten la transferencia, combinación y aplicación del conocimiento nuevo (Lane et al., 2006; Cohen y Levinthal, 1990). En este sentido, señalamos que la capacidad de absorción surge como fruto del conocimiento generado a partir de estos vínculos y de la complementariedad entre los distintos procesos de aprendizaje. Será esta capacidad de absorción, la que permita catalizar el efecto de la estrategia de búsqueda de conocimiento externo hacia un mayor desempeño. Por ello, las deficiencias que las organizaciones puedan presentar en los niveles de desempeño innovador o de desempeño general pueden ser producto de los bajos niveles de capacidad dinámica de absorber conocimiento y no sólo de los peligros de que información privilegiada se pueda filtrar al mercado (Katila y Ahuja, 2002) tras el incremento de los vínculos con agentes externos.

En cuanto a las implicaciones prácticas, argumentamos que los directivos deben ser conscientes de la importancia que tiene, no sólo el desarrollo de relaciones amplias y profundas con agentes externos, sino también el crear las condiciones que faciliten la correcta identificación, transferencia y

explotación de dicho conocimiento, ya que el simple acceso al conocimiento disponible en estas fuentes no es suficiente. También, resaltamos que es importante que los directivos desarrollen cierto nivel de ambidiestria en la búsqueda de conocimiento externo y gestionen la colaboración tanto con agentes tecnológicos como con agentes ligados a la cadena de valor. Sin embargo, para ser capaces de generar ventajas competitivas es muy importante que los directivos desarrollen estrategias enfocadas a generar sinergias entre la búsqueda de conocimiento externo y la promoción de factores a nivel interno que faciliten la transformación y explotación del conocimiento incorporado.

Por último, también es importante que las entidades públicas tomen en cuenta las consideraciones antes señaladas para desarrollar políticas de fomento a la innovación y de colaboración entre instituciones tanto públicas como privadas. Como se ha podido evidenciar en nuestro estudio, sólo una parte de las empresas son capaces de beneficiarse de este tipo de actividad. Por ello, consideramos que es importante que los responsables políticos ayuden a crear conciencia sobre la importancia de este tipo de colaboraciones para la mejora del desempeño organizativo y por lo tanto, la creación de valor en la economía.

6.2 LIMITACIONES Y FUTURAS LÍNEAS DE INVESTIGACIÓN

Debemos tener en cuenta que este trabajo no está exento de limitaciones que abren nuevas puertas a investigaciones futuras. En primer lugar, los datos de la encuesta provienen de la autoevaluación de los directores. Esto puede presentar cierto nivel de sesgo de deseabilidad social (Podsakoff and Organ, 1986). Sin embargo, antes de contestar a las distintas preguntas aseguramos el anonimato de los encuestados, lo cual puede ayudar a reducir este tipo de sesgo incluso cuando los encuestados responden a aspectos delicados (Konrad and Linnehan, 1995). En segundo lugar, la presente investigación es de corte transversal. Este aspecto limita

demostrar de forma concluyente aspectos de causalidad así como causalidad inversa. Aunque es probable que las condiciones bajo las cuales se recogieron los datos sigan siendo las mismas, no tenemos garantías de que esto sea así. También, cabe destacar que no es posible evaluar si los factores o las capacidades identificadas en el estudio tienen implicaciones adicionales en el desempeño que las organizaciones alcanzan a lo largo del tiempo. Estas limitaciones podrían ser cubiertas a través del desarrollo de estudios longitudinales.

Por otro lado, aunque los dos primeros estudios fueron llevados a cabo en sectores industriales distintos (lo cual proporciona cierto nivel de robustez a los resultados), el último de los análisis fue realizado en un único sector. Aunque esto último nos permite abordar empresas que son más homogéneas en términos de los procesos de aprendizaje y de las estrategias de búsqueda de conocimiento externo, los resultados deben ser interpretados con precaución, ya que no es posible generalizar a otros sectores. Futuros estudios podrían replicar este estudio y analizar si el efecto mediador de la capacidad de absorción en la relación existente entre las estrategias de búsqueda de conocimiento y el desempeño es el mismo en otros sectores de alta tecnología o en sectores tradicionales.

Estudios futuros podrían evaluar cómo otros factores internos a las organizaciones (como por ejemplo la estructura organizativa, la cultura o las prácticas de recursos humanos) inciden de manera distinta sobre los procesos de aprendizaje que contribuyen a la capacidad de absorción. Hasta el momento, varios de los estudios que han analizado estas relaciones se han limitado a analizar la capacidad de absorción en base al conocimiento previo existente en las organizaciones y no contemplan el carácter multidimensional del concepto. Profundizar sobre estas relaciones nos permitiría entender cuáles son las principales deficiencias que las organizaciones presentan en el desarrollo de esta capacidad.

Por último, destacar que serían interesantes nuevos estudios que evaluaran cómo la turbulencia del entorno podría moderar el efecto que las estrategias de búsqueda de conocimiento externo tiene sobre el desarrollo de los procesos de aprendizaje. Aunque la mayor parte de los estudios previos se han centrado en analizar cómo la turbulencia del entorno afecta al efecto que tiene la capacidad de absorción sobre el desempeño innovador o el financiero (Lichtenthaler, 2009; Jansen et al., 2005), la clase de turbulencia presente en el entorno (como por ejemplo, turbulencia de mercado o turbulencia tecnológica) también podría actuar como agente que impulse *(activation trigger)* la necesidad de las organizaciones a realizar una búsqueda amplia y profunda de conocimiento (Zahra y George, 2002).

6.3 BIBLIOGRAFIA

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